MAY, 1960

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

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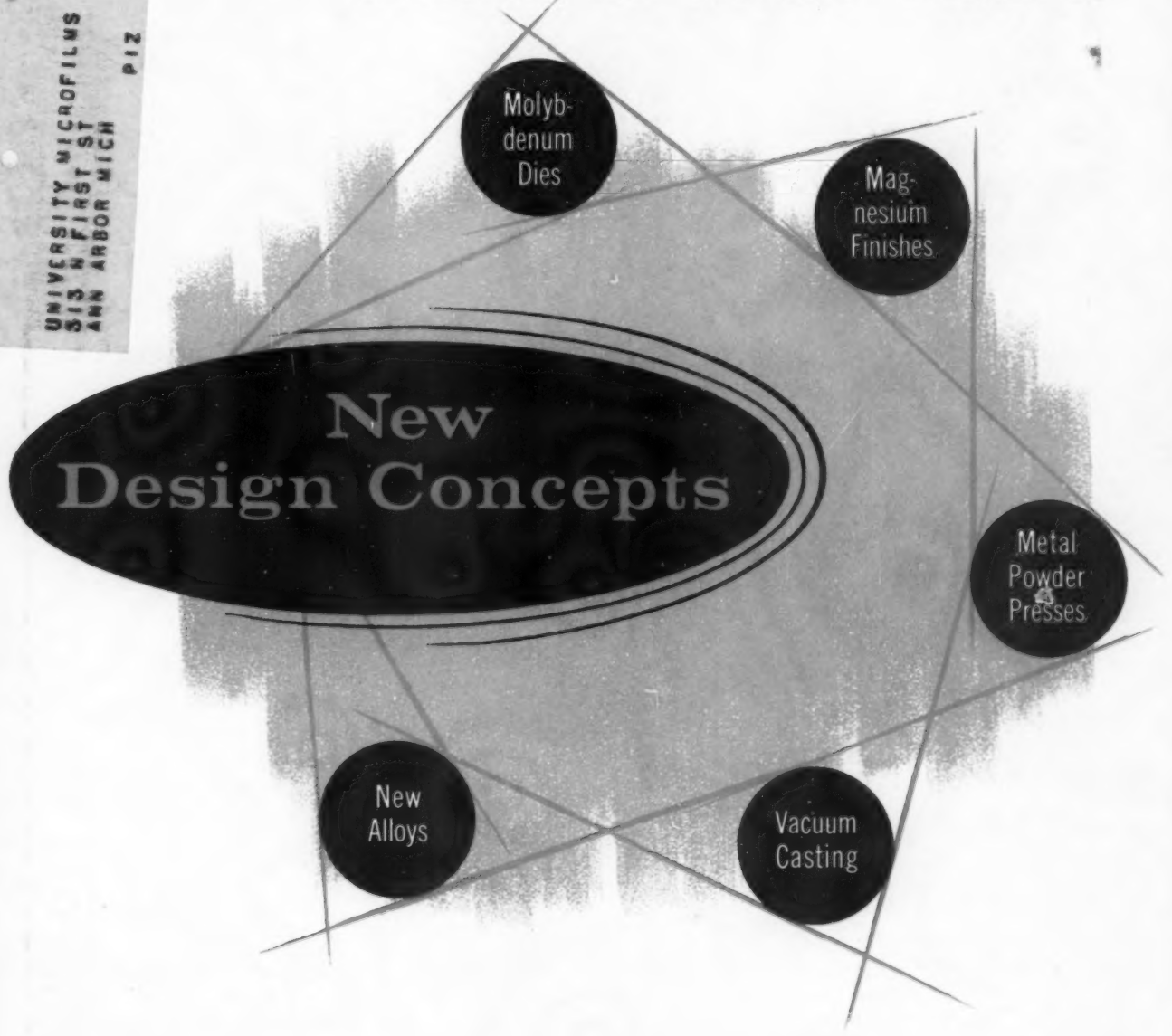

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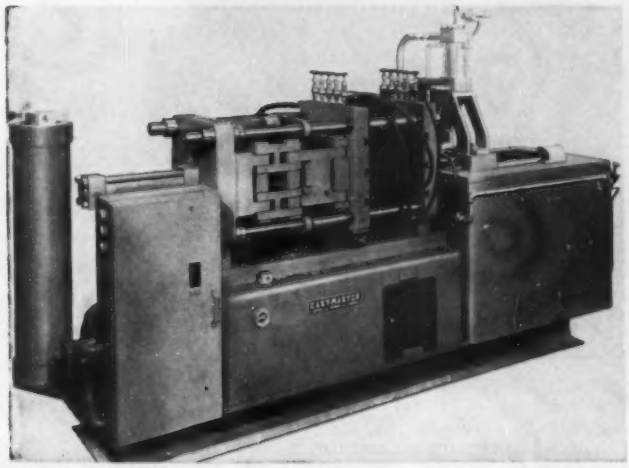
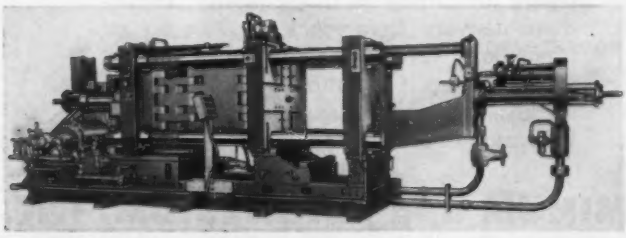


MODEL 7Z 100-ton hot chamber automatic for high speed production of small castings.



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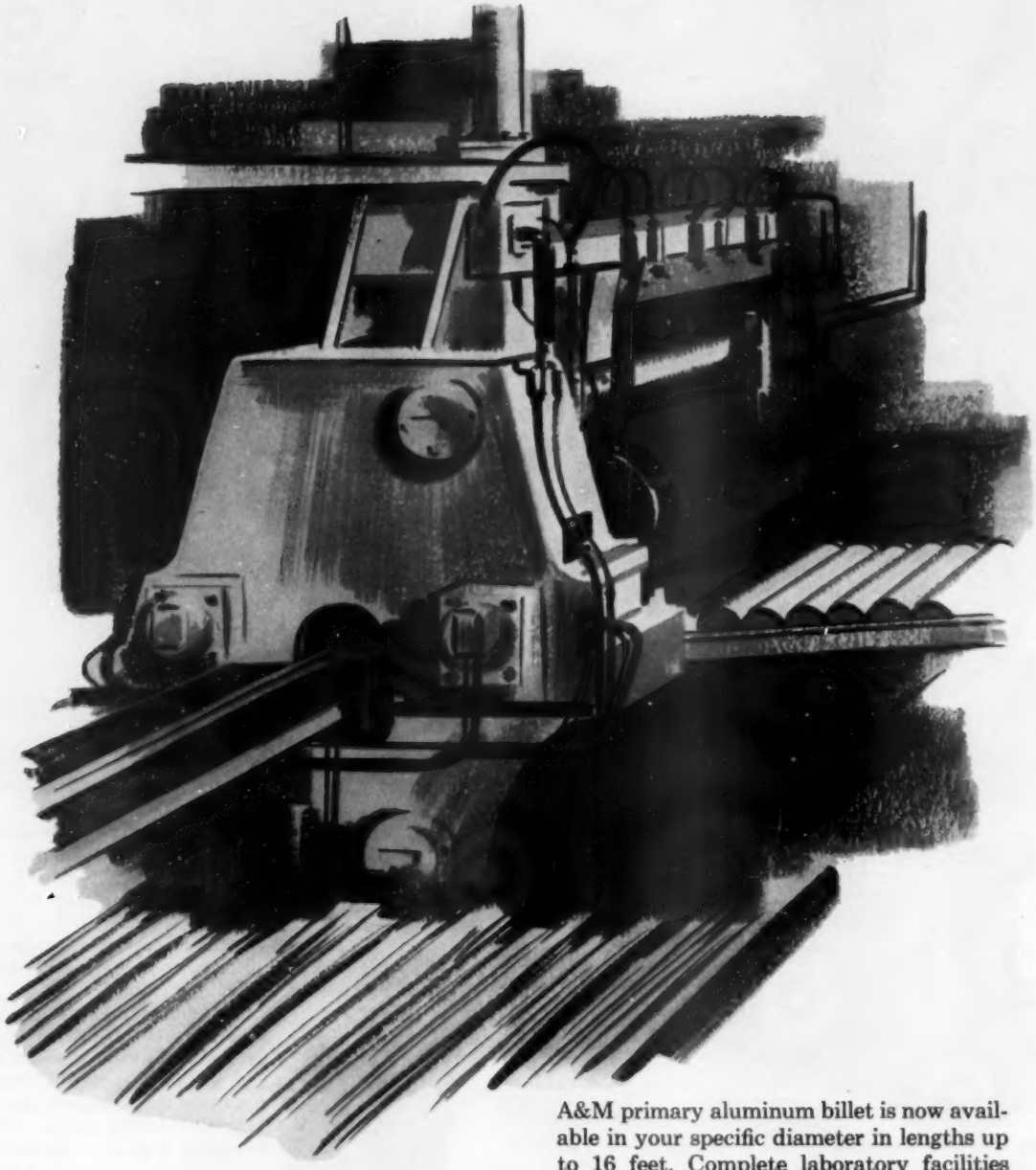

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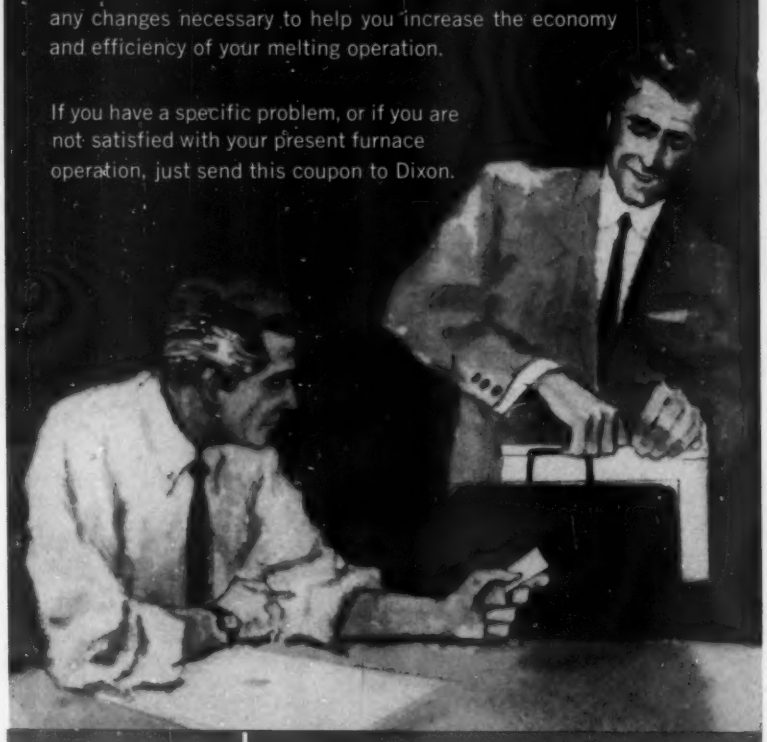

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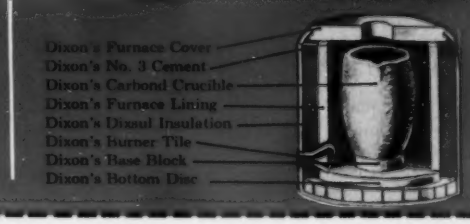

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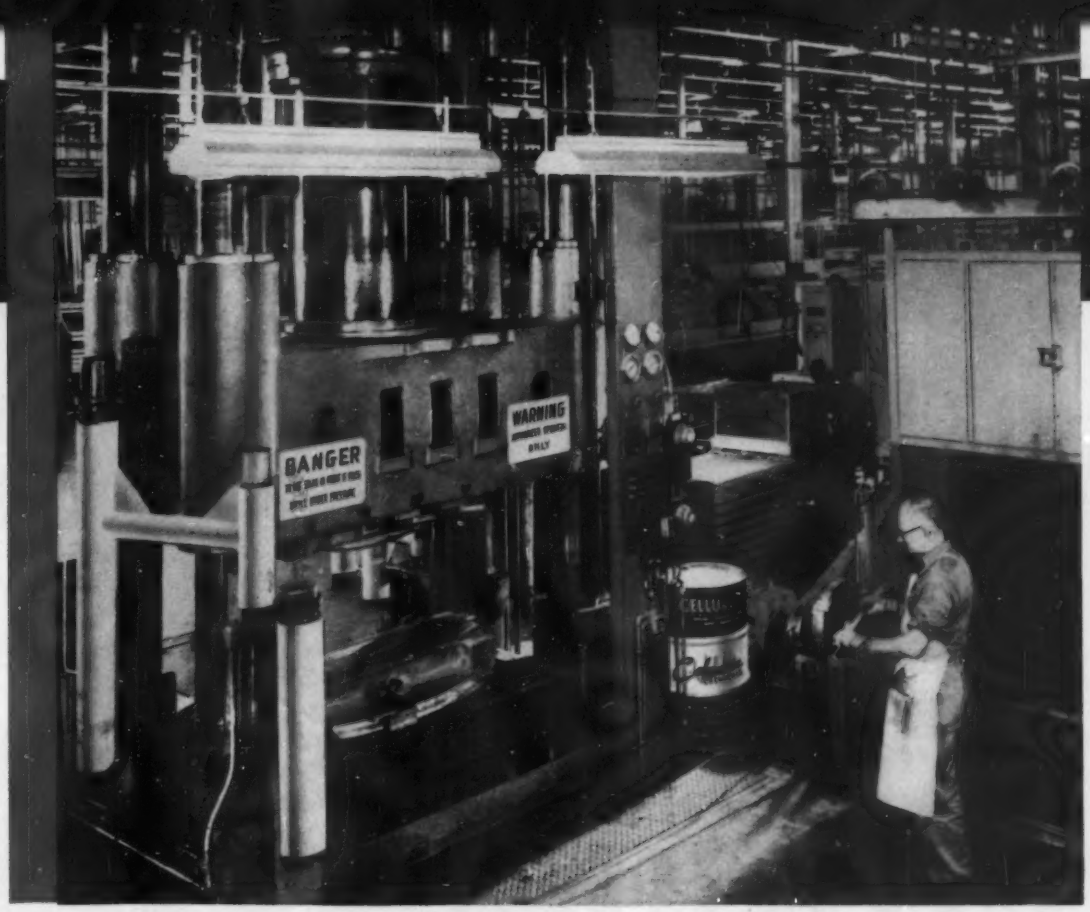

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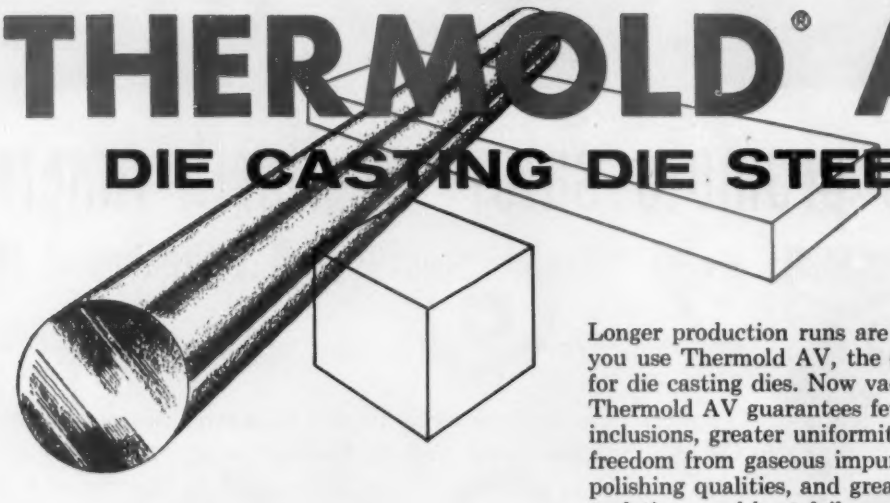

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CASTING ABOUT

technical news of applications & process involving precision metal molding

ELECTRON BEAM USED FOR MELTING, MACHINING, AND WELDING

A new, high energy type of electron beam machine capable of far higher energy levels and more accurate control than any previous equipment has been developed by the Carl Zeiss Foundation in West Germany. Temperatures high enough to melt and vaporize any known metal can be developed. Along with these extremely high temperatures is control of a high degree. Holes finer than human hair can be drilled.

The basic equipment consists of an electron gun which can develop a precisely controlled beam of electrons of high energy density; a vacuum chamber with a work table and accurate positioning means for locating the work piece. The high-vacuum system can evacuate the equipment to below 0.1 microns. Other vital pieces of equipment are deflectors and lenses to control the size and programming of the electron beam.

When used for welding, the electron beam produces little or no distortion and a very narrow heat affected zone. Generally it operates with a depth to width ratio of 20 to 1.

When used for machining the results with electron beam machines are even more spectacular. For example, holes and slots as small as 0.0008" in width or diameter can be formed. With the higher energy contemplated for the near future even smaller holes will be drilled. Naturally, intense heat is generated at the target point during these operations. With a target temperature of 11,000°F the metal temperature only one micron away from the cut is 550°F.

Metals aren't the only materials which can be machined with this equipment. Jewels for watch bearings are drilled at the rate of six seconds per hole and production size equipment will handle up to 10,000 jewels per load.

Another application is the machining and welding of miniature and sub-miniature electronic assemblies widely used in missile guidance systems.

ZINC-COLUMBIUM COATING FOR OXIDATION RESISTANCE

Columbium is becoming increasingly important as a material for nuclear reactors, jet engines, and other high temperature applications. But its useful properties are negated by its poor oxidation resistance.

Columbium has all the essentials for a good base metal for the development of superior high-temperature alloys except for its poor oxidation resistance. Alloy additions give some oxidation resistance but only at the expense of high-temperature strength or of fabricability or both.

In addition to giving protection against oxidation, a good coating must also be self-healing. Such a coating appears to be found in the zinc-columbium intermetallic compound. By simply dipping the columbium into molten zinc the intermetallic compound is formed. The layer is then further reacted with the base metal by a diffusion anneal at about 1600°F.

The zinc-columbium intermediate phase is hard and brittle. It is easily cracked by mechanical or thermal shock. It is, however, firmly anchored to the base metal so that there is no spalling and it can be dislodged only with difficulty.

A protective layer made from unalloyed zinc and unalloyed columbium has given good surface protection for several hundred hours at 1800°F and for a few days to a few hours in the 2000° to 2200°F range in still air. Further, the protection was good against hydrocarbon combustion products moving at 500 ft. per second with a metal temperature of 2000°F. The coating is, of course, self healing.

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The space platform will be about 32 ft. long and 24 ft. wide. It will be held above the water surface by a giant, low pressure air blast.

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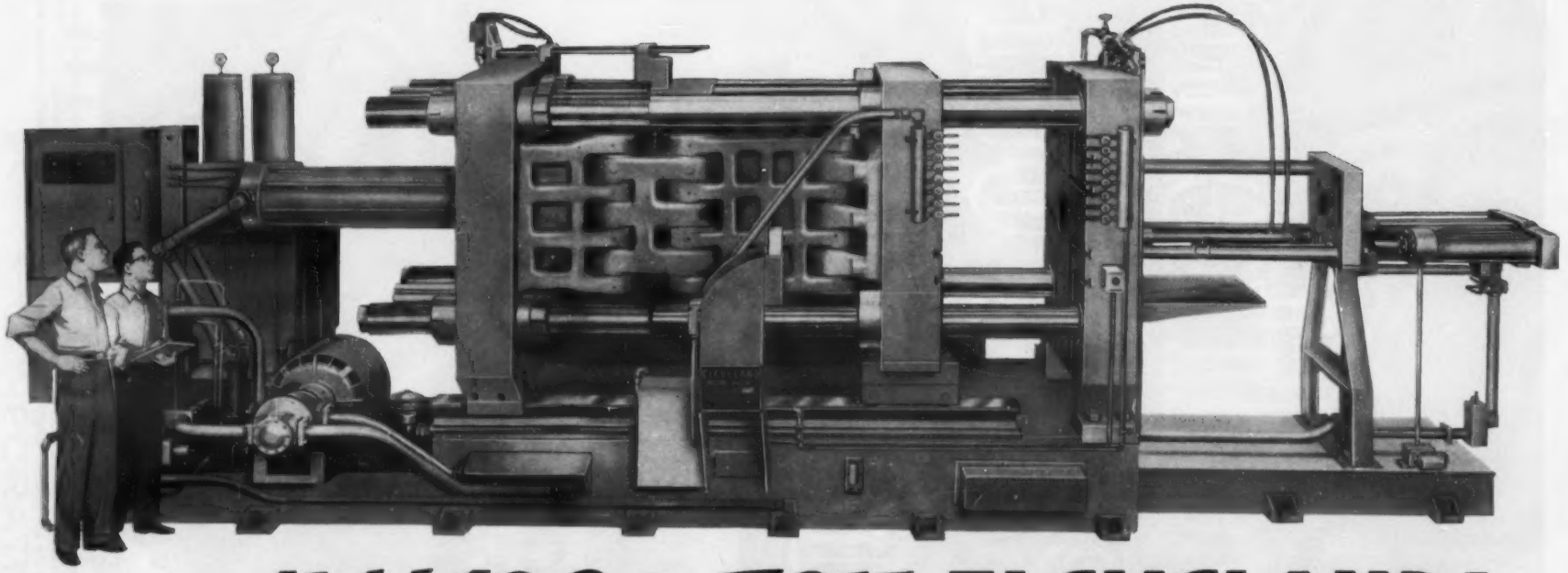

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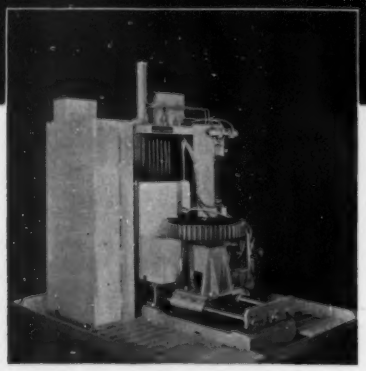

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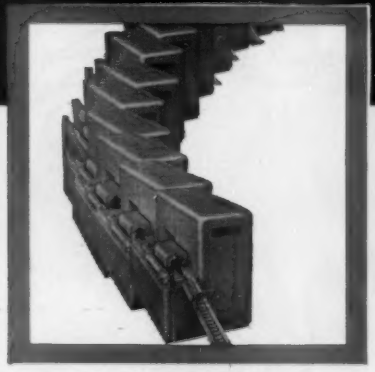

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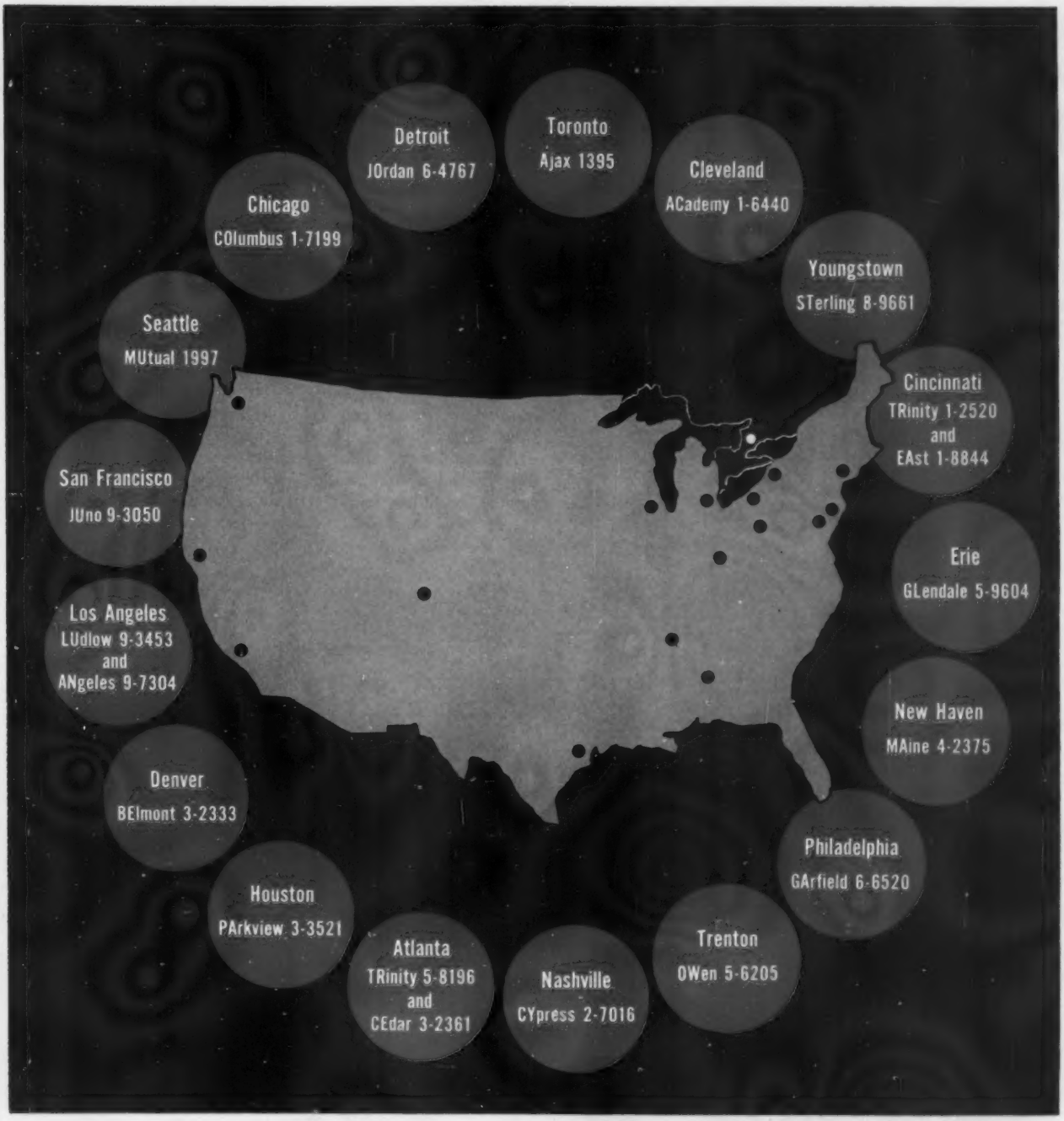

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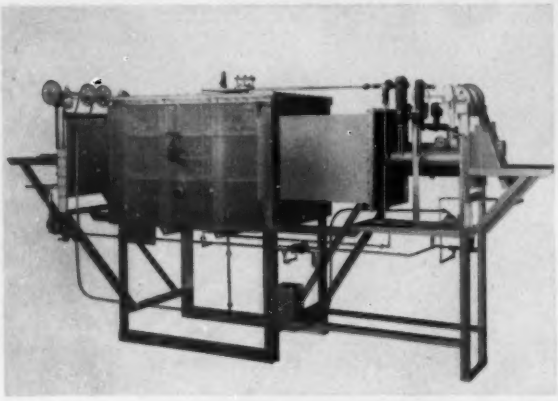
NEW PRODUCTS AND DEVELOPMENTS

Qualified readers can get complete details on these products. Use the Reader Service Cards. You'll find them facing page 102 of this issue

ELECTRIC FURNACES FOR HIGH-TEMPERATURE CERAMIC AND ELECTRONIC APPLICATIONS



C. I. HAYES, INC.—The type M-Y series of compact research and production electric furnaces provide uniform heat at temperatures to 3300°F. They can be used with a variety of non-oxidizing, reducing or inert atmospheres. The units were intended for ceramic metallizing, specialty sintering, silicon depositing and diffusing, and for developing new heat treating techniques in close-tolerance, high-temperature applications. They have molybdenum wound muffles for maximum length of temperature uniformity and water-jacketed cooling sections with precise temperature regulators. Other features include extended insulated throat areas to minimize thermal shock and automatic feed mechanisms.

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SINGLE RETURN WATER LINE FITTING FOR DIE COOLING

PAR-VIN CO.—The model Y-250 single return water line fitting permits the cooling of dies in any area, including those through which water lines cannot be placed. They can also be used to cool cores. The fitting is versatile since it can be used coming out of the back or sides of holding dies. To install, copper tubing is cut to suit, as shown, and pipe lengths are screwed into the impression block.

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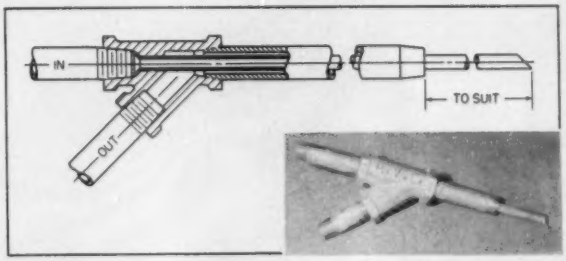
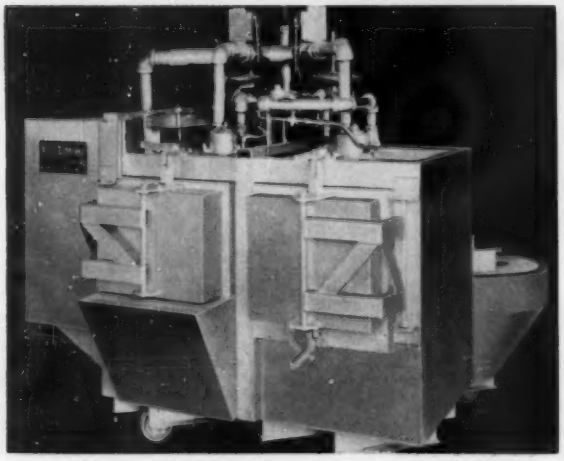


ALUMINUM MELTING FURNACE DESIGNED FOR USE WITH DIE CASTING MACHINES



J. A. KOZMA CO.—The model RSHCH radiant fired aluminum melting furnace was especially designed for use with die casting machines. A "Pre-Temp" charging knee prevents aluminum ingots from entering the bath until they have reached a plastic state. Zone dividing walls extend below the bath surface. These two features keep the purity level high by almost eliminating hydrogen pick-up and oxide inclusions. Radiant panel firing provides fast, uniform heat distribution, eliminates flame impingement and reduces fuel costs. The furnace is available in a wide range of capacities. The Kozma Co. says this furnace is unequalled for the production of low porosity aluminum castings and is recommended by several die casting machine builders.

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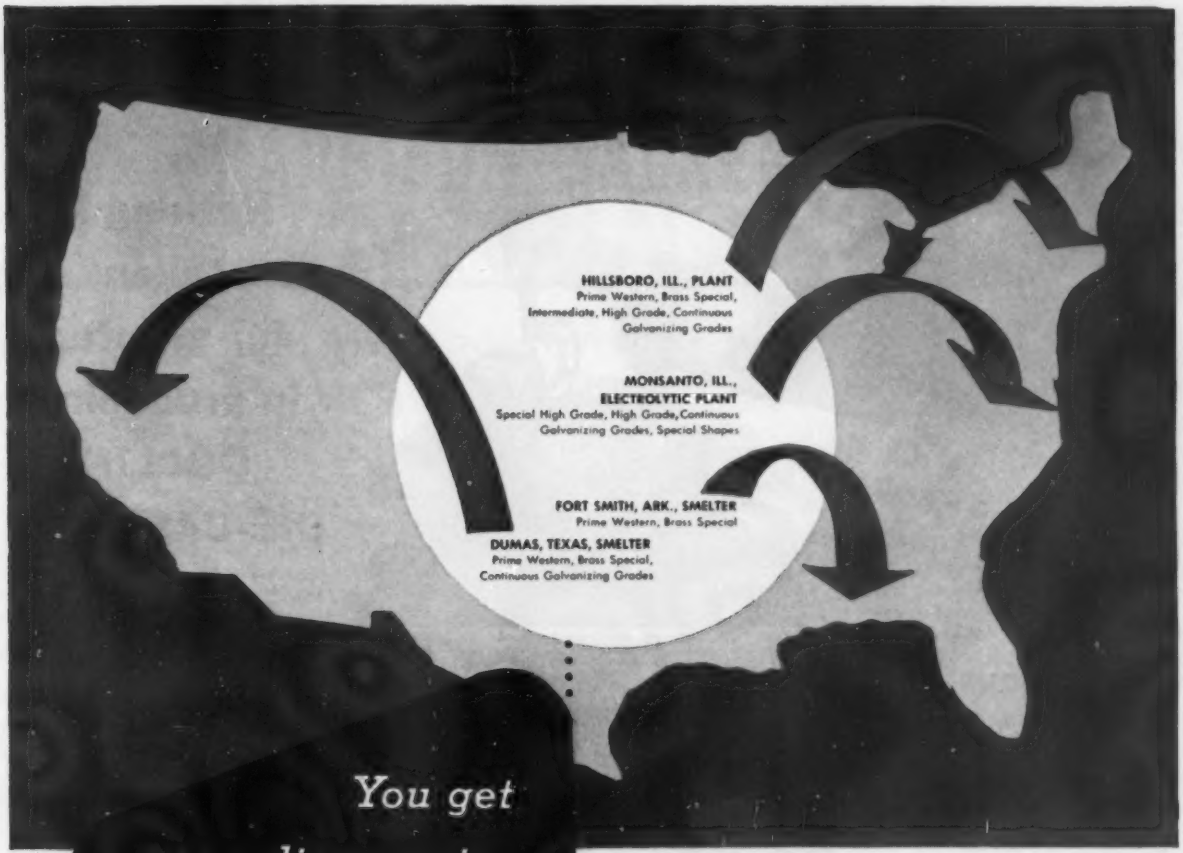
continued on page 80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CHECK-and DOUBLE CHECK!

Nothing is taken for granted in producing DOLLIN DIE-CASTINGS

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- ☑ DIES
- ☑ METALLURGY
- ☑ CASTINGS
- ☑ MACHINING
- ☑ INSPECTION
- ☑ SCHEDULES

checked at every step

You can depend on Dollin to deliver on-grade, on-size die-castings . . . on time. Dollin combines extensive, high-speed equipment with a thorough system of production checks and quality controls to meet your strictest requirements. For example:

Dollin guarantees all zinc alloys under the "C-Z" Certified Zinc Alloy Plan. Aluminum alloys are carefully controlled—spectrographically certified, if needed. Continuous floor inspection is given castings at each stage of production. In addition, final inspection is made by trained inspectors. Sales service managers constantly check progress, maintain schedules, give you prompt answers on any job details.

If you're looking for a reliable die-caster with the know-how and equipment to produce quality die-castings at attractively low prices . . . send your prints or samples of parts to Dollin for engineering advice and quotation, without obligation. Write for the 16-page Dollin illustrated facilities booklet.

DIE CASTING RESEARCH FOUNDATION PARTICIPANT

DOLLIN Zinc & Aluminum DIE-CASTINGS

Dollin Corporation, 614 So. 21st Street, Irvington 11, N. J.

Sales Offices: Boston • Buffalo • Canton • Chicago • Detroit • Greensboro Louisville • Memphis • Philadelphia • St. Paul • St. Petersburg, Fla.

See "Yellow Pages" for nearest office.

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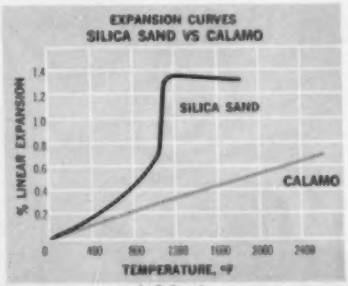
FOR BETTER METAL CASTING... HARBISON-WALKER REFRACTORY MOLD MATERIALS

Calamo for investment molds



CALAMO, one of the extensively used Harbison-Walker products for molding, is an alumina-silica refractory of optimum sizings for various molding mixtures. Its fusion point is 100°F. higher than that of normal silica sand mixes.

The chart shows the exceedingly desirable expansion curve of CALAMO compared with that of silica.

CALAMO, used as the major constituent of precision casting investment mixes, improves dimensional constancy of molds, makes them stronger and more resistant to erosion by metal flow.

Investment costs are measurably reduced because an appreciably lesser amount of bonding agent is needed. This is attributable to the very desirable particle sizing and the equiaxed, dense grains of CALAMO.

CALAMO, used alone or as the major part of conventional dry sand molding mixes in rammed, or in slinger-place sand molds, provides not only the very desirable low thermal expansion particularly suited for precision casting but also the refractoriness for metals and alloys melted at unusually high temperatures.

H-W Flintgrain for ceramic shell molds

H-W FLINTGRAIN is an alumina-silica refractory, similar in composition to CALAMO, having the same very desirable low thermal expansion characteristics, but greater angularity of grain shape.

The angular grain shape and optimum size distribution make H-W FLINTGRAIN ideal for securing maximum compactness in the mold. It is used with special benefit for making ceramic shell molds and for similar applications in which dense, compact mold sections of greatest volume stability at all temperatures, are of paramount importance.

Illustration of angulate shape of H-W Flintgrain enlarged x3

H-W Mullite grains and flours for precision molding of metals at extremely high temperatures

These H-W MULLITE products by virtue of their high-alumina composition and low content of basic oxides are very refractory. The hard dense grains are strong and most resistant to fluxing. Excellent thermal stability accounts for their unusual constancy of volume up to their temperature limit. Thermal expansion of these H-W MULLITE products corresponds closely to that of CALAMO. These are the properties of H-W MULLITE GRAINS and FLOURS which commend them for precision casting work at very high temperatures.

HARBISON-WALKER REFRACTORIES CO.

AND SUBSIDIARIES

World's Most Complete Refractories Service **GENERAL OFFICES: PITTSBURGH 22, PA.**

HW 60-8A

Circle No. 90 on Reader Service Card

These L.D.C. Aluminum Die Castings help keep a marine radar system on the beam

Indicator Unit of the new Sperry Radar 5. Control housing and indicator frame are L.D.C. corrosion-resistant aluminum alloy.

There's no guesswork with the new Sperry Radar 5, the navigating aid and anti-collision device for small boat operators. It enables the pilot to obtain relative bearings of other vessels and objects within range . . . allows the navigator to sight land falls . . . offers greater safety at night and during bad weather.

Reliability and diversity of the Sperry Radar 5 are made possible through modern design and precision engineering, sparked by complex and quality-proven parts . . . that include L.D.C. corrosion-resistant aluminum alloy die castings.

Latrobe Die Casting Co.
Latrobe, Pennsylvania

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BUFFALO, N.Y. Harry W. Harding 235 Burke Drive Tel: Amhurst 1164	**DAYTON, OHIO** J. M. Gallaher 363 West First St. Tel: Baldwin 4-3523	**PHILADELPHIA, PA.** Albert B. Reid 505 Wadsworth St. Tel: Chestnut Hill 7-8833	*Established 1918*

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WE NEVER COMPETE WITH OUR CUSTOMERS

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Achieve new dimensions and strengths with...

HS6460 HIGH STRENGTH ALLOY POWDER

Republic's HS6460 is a soft, alloy powder that makes possible higher tensile strengths than ever before achieved with ferrous powders on existing production equipment. It is capable of a minimum tensile strength of 60,000 psi at 6.4 density—100,000 psi after heat treatment. Excellent carbon compatibility enhances the powder's ability to be heat treated.

HS6460 is ideally suited for use in all major ferrous powder metallurgy applications. It can be used to produce comparable strength structural parts at lower manufacturing costs than obtainable with copper infiltration.

Larger parts can be fabricated on normal pressing equipment because of HS6460's excellent compressibility. Manufacturing costs can be reduced because fewer operations are required to obtain high density, higher strength parts.

For technical data on HS6460 High Strength Powder, including fatigue and impact test results, write Republic Steel, Dept. PM-9002, 1441 Republic Building, Cleveland 1, Ohio.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

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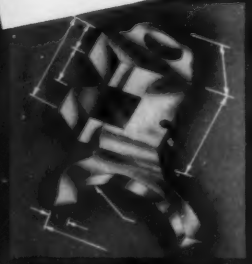
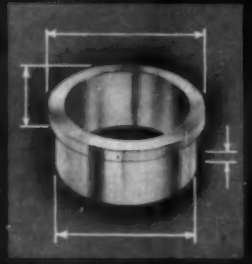
engineering for **both** cost and mechanical requirements in the bearing field . . .

Bunting can help you identify and procure the bearing or part that will do your job at the lowest possible cost. Often a re-examination of the actual mechanical needs of a bearing application reveals an opportunity to save money in design. Another saving is almost invariably achieved by considering ALL the new bearing materials which Bunting makes available to you today. Let Bunting help you engineer your bearing application in the light of modern availabilities. Send in your blueprints or ask for engineering counsel.

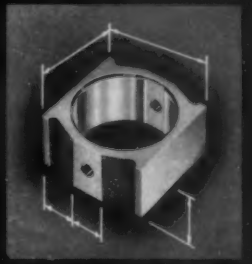
...case in point*



*Clearly evident is the economy in the production of this shifter fork by Bunting Powder Metallurgy. The elimination of machine work effects striking cost reduction.



*This cylinder gland bearing made of Bunting Bearing Aluminum is an example of how to save weight and money on the cost of large, thick-wall bearings and parts.



*This cast bronze cam block, made to unusually close limits with very fine finish, is absolutely round and true to size with cost at a feasible figure.

*Solid cast aluminum gear bearing to replace roller bearing for longer life and lower cost.

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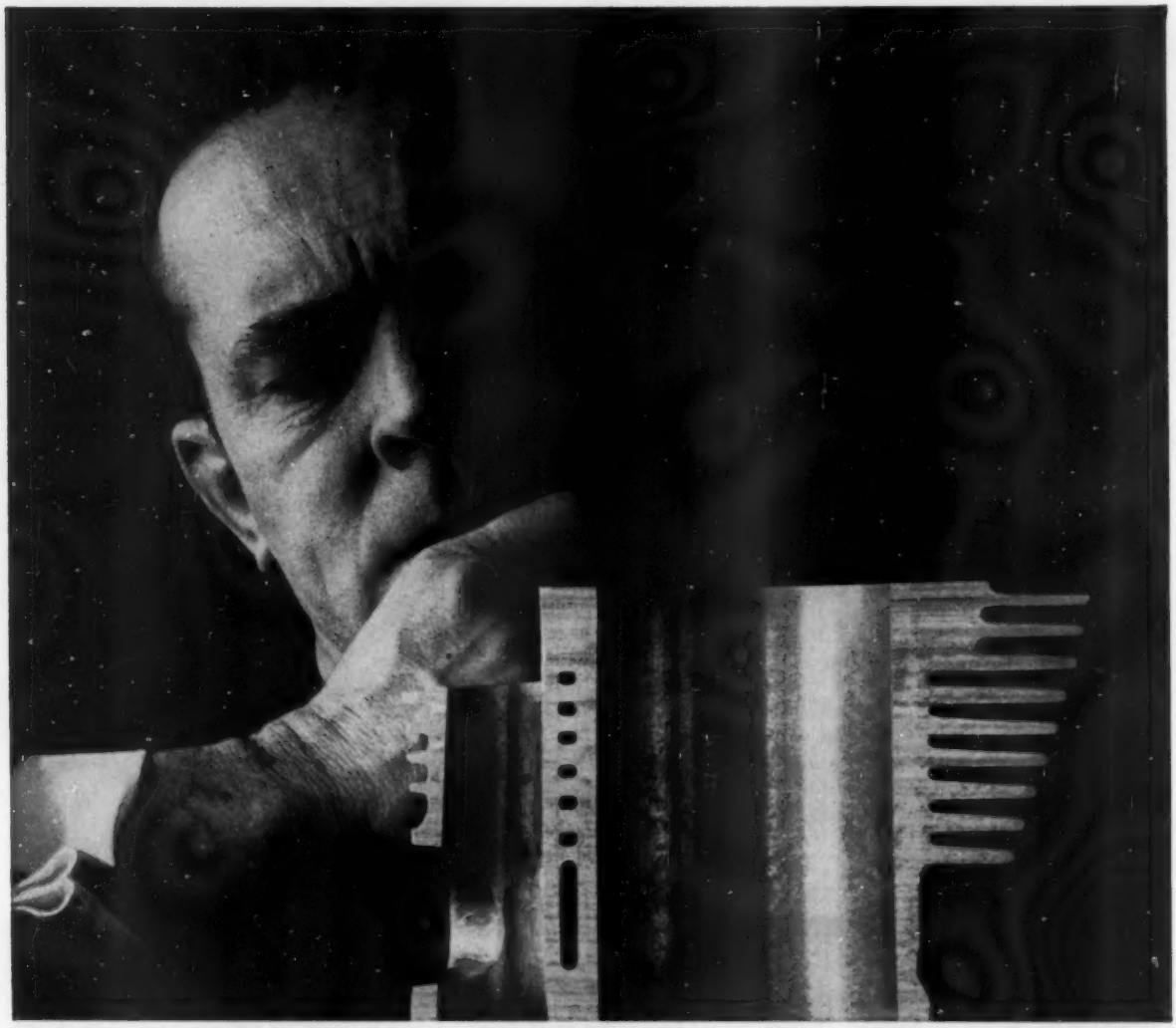

THE PERPLEXING PROBLEM OF HARD SPOTS

Another costly mystery solved—by the man from Kaiser Aluminum

THE PUZZLING FACTS. An aluminum foundryman recently made a disturbing discovery: his castings contained many inclusions and hard spots. These made the castings very unsatisfactory. In addition, they were difficult to machine—and caused excessive wearing of tool bits.

HOW THE CASE WAS SOLVED. It was a frustrating problem. But the man from Kaiser Aluminum found the fault: ineffective fluxing and degassing techniques. When these were corrected, the hard spots disappeared and production returned to normal.

WE LOVE A MYSTERY. This is one of many actual cases solved by Kaiser Aluminum working with a customer. Perhaps *you* have a mystery one of our engineers might help solve? He'll give you expert advice on any casting problem—including conversion from cast iron to aluminum, mold and die design, alloy selection, heat treatment, finishing, fluxing, metal transfer.

FULL ALLOY AVAILABILITIES. Kaiser Aluminum can supply you *fast* with a wide selection of casting alloys to suit any engineering requirement—from general purpose, low stressed alloys to high purity alloys having good properties at elevated temperatures.

FOR PIG AND INGOT with a free sleuthing bonus, call your nearest Kaiser Aluminum sales office or any of the distributors listed on the opposite page. Or write to: Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive, Oakland 12, California.

KAISER ALUMINUM*

THE BRIGHT STAR OF METALS

*Trademark Kaiser Aluminum & Chemical Corp.

See "MAVERICK" • Sunday Evenings, ABC-TV Network • Consult your local TV listing.

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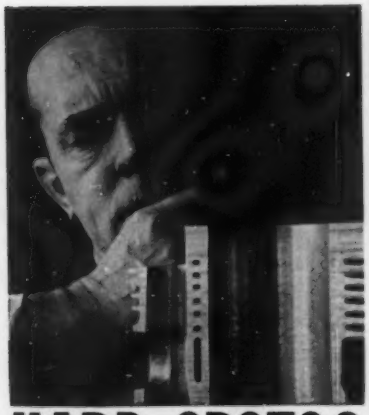

HARD SPOTS?

Your Kaiser Aluminum ingot distributor is more than a nearby source for aluminum pig and ingot. He's ready to render specialized advice on anything from alloy selection to fabricating methods. And "Service" is his middle name!

CALL YOUR NEAREST

KAISER ALUMINUM*

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Michigan Standard Alloys Sales Co., Inc.
WAlnut 5-2195

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Samuel Greenfield Co., Inc.
HUMboldt 4050

CHICAGO, ILLINOIS
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VIrginia 7-1800

CLEVELAND, OHIO
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Liberman & Gittlen Metal Co., Inc.
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HOUSTON, TEXAS
Gulf Reduction Corp.
WAlnut 6-2425

LOS ANGELES, CALIFORNIA
Aaron Ferer & Sons, Inc.
MAdison 5-1553

PHILADELPHIA, PENNSYLVANIA
George Sall Metal Co., Inc.
Pioneer 3-2828

WEST SPRINGFIELD, MASSACHUSETTS
New England Smelting Works, Inc.
REpublic 4-6491

*TRADEMARK KAISER ALUMINUM & CHEMICAL CORP.

LETTERS

the readers' forum

PERMANENT MOLD EQUIPMENT

We would like to know if you know of any company that is able to furnish some standard or universal rack and pinion operating device or table, for manually operating and closing the dies for permanent mold aluminum casting.

It is our thought to purchase or make up a couple of these devices that could be used somewhat universally for simple dies that might cover a range of say 10" x 10" x 16" to 18" outside.

If you could advise where we could purchase them, or even the design of same, we would be grateful. Also advise, if possible, where we might buy some of the parts such as the flat iron top, pull blocks, racks, pinions and other parts that are used on these devices.—R.F.W., pres.

The names of some suppliers have been forwarded.—Ed.

INVESTMENT CASTINGS

We have a request from our chief design engineer for sources of supply in the local area for a precision cast part of stainless steel or nickel silver, the part measuring about 3" x 1¼".

Can you furnish us with the names of some sources of supply to which we might send drawings to receive information on price and delivery.—L.C., sales mgr.

A copy of the latest investment casting directory has been sent.

OUR SLIP

The very thorough story in your February issue on our new die casting plant in Bay City, Michigan, erroneously reported that generated scrap from the die casting machines and trim presses is carried by belt conveyor to remelt furnaces. We use roller conveyors to move raw castings from the machines to the trimmers. Forklift trucks haul scrap to the furnaces in ordinary scrap bins.—Clayton L. Dickey, The Dow Metal Products Co., Div. of The Dow Chemical Co., Midland, Mich.

continued on page 74

with

SPINCRAFT LADLES

Light, rugged, Spincraft ladles save replacement costs, make every pouring job easier! Available in a vast range of sizes, in stainless steel as well as mild.

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LIGHT IN WEIGHT
LESS FATIGUE!

•

NON-SPILL SHAPE
NO WASTE!

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EQUIPOISED HANDLE
BALANCED!

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SKILL WILL DO IT
INCORPORATED

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BETHLEHEM CROMO-HIGH V TOOL STEEL

...ideal for casting in the 1200 to 1300 F range

If you are die casting aluminum-base or magnesium-base alloys at about 1200 F to 1300 F, you will find Bethlehem Cromo-High V tool steel (AISI H-13 type), one of the most economical choices you can make.

Cromo-High V is ideal for die casting in this temperature range because of its 5 pct-chrome, high-vanadium content. Cromo-High V is economical because it comes in the annealed condition to Brinell 207, and therefore is easy to machine. This die casting grade strongly resists the formation of a fine network of heat checks. Moreover, Cromo-High V develops uniform hardness in large sections during heat-treatment, enabling it to resist wash and erosion.

Typical Analysis

C	Cr	V	Mo	Si
0.40	5.25	1.05	1.25	1.00

Put Cromo-High V to work at your first opportunity. Your local Bethlehem tool steel distributor will be pleased to work closely with you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

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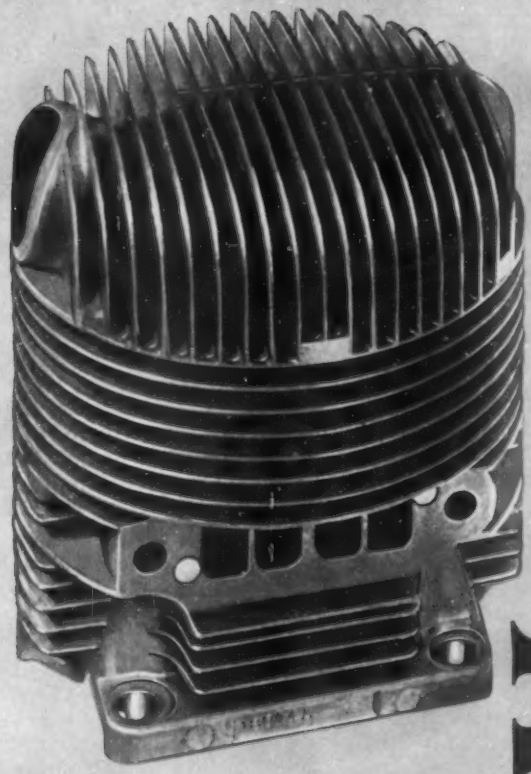

Your most convenient,
most complete source:

FEDERATED ALUMINUM DIE-CASTING ALLOYS

When you buy Federated aluminum alloys, you can count on near-by supply from a wide-spread distribution system. You can call on technical assistance from conveniently located sales offices, and field metallurgists. You are always assured of ingot, precisely controlled by production methods developed and supervised by Asarco's Central Research Laboratories, and distinguished for identical characteristics from order to order. For consistent quality in aluminum die-casting, write or call Federated Metals Division, American Smelting and Refining Company, New York 5, or RE 2-9500, or call your nearest Federated sales office.

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

FEDERATED METALS DIVISION

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St. Louis: Jackson 4-4040

BALTIMORE, MARYLAND
Orleans 5-2400

BIRMINGHAM, ALA.
Fairfax 2-1802

BOSTON 16, MASS.
Liberty 2-0797

CHICAGO, ILL. (WHITING)
Chicago: Essex 5-5000
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Locust 7-5129

PITTSBURGH 24, PENNA.
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PORTLAND 9, OREGON
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Circle No. 8 on Reader Service Card

NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

AMERICAN ZINC INSTITUTE HOLDS ANNUAL MEETING IN ST. LOUIS

The 42nd annual meeting of the American Zinc Institute was held in St. Louis, April 7 and 8. The board of directors reelected all incumbent officers to serve for another year. The officers are: president, R. G. Kenly, vice president, The New Jersey Zinc Co.; vice presidents, T. A. Campbell, Anaconda Sales Co., H. D. Carus, Matthiessen & Hegeler Zinc Co., E. H. Snyder, Combined Metals Reduction Co.; treasurer, G. H. LeFevre, U.S. Smelting Refining and Mining Co.; executive vice president and secretary, J. L. Kimberley.

Directors elected for the term expiring in 1963 are: T. A. Campbell, Anaconda Sales Co., A. C. Eide, American Zinc, Lead & Smelting Co., S. S. Goodwin, The New Jersey Zinc Co., T. K. Graham, The Anaconda Co., H. E. Lee, The Bunker Hill Co., G. W. Potter, Potter-Sims Mines, Inc., E. A. Torney, The Bunker Hill Co., H. I. Young, American Zinc, Lead & Smelting Co, and M. M. Zoller, The Eagle-Picher Co.

In reviewing the past year, uses of zinc reported showed substantial gains over 1958. Die casting uses of zinc showed a gain of about 17%. According to Kimberley, the prospects for 1960 are excellent. In the die casting field, zinc's position has been strengthened by the improved electroplating techniques.

In his review of the expanded research program, Dr. Schrade F. Radtke, director of the program, reported marked success in two areas of investigation, and significant progress in several others. The research budget for 1960 has been increased by 50%. This represents funds made available to support active research. If the contributions of supporting companies were included, the increase for research would be at least 75%, Radtke said. This increase indicates clearly how important the membership views the need for new developments.

DIE CASTING EXPOSITION & CONGRESS OFF TO GOOD START

Sixty days after the formal announcement of the first National Die Casting Exposition and Congress, 40% of the exhibit space has been sold, according to John L. MacLaren, chairman. This active sale of space, is a good indication of the need for an exhibition in and for the die casting industry.

Companies who have already contracted for space are: Alliance Mold Co., Apex Smelting Co., Aldrich Industrial Oils, British Industries Corp., Bendix Aviation Corp., Crucible Steel Co. of America, Cast-Master Div., Koehring Co., The Cleveland Automatic Machine Co., Dodge Steel Co., The Dow Chemical Co., Detroit Mold Engineering Co., Ford Motor Co., Greenlee Bros. & Co., Gries Reproducer Corp., Jervis Corp., J. A. Kozma Co., Kux Machine Co., Lester-Phoenix, Inc., Latrobe Steel Co., Lindberg Engineering Co., Litemetal Diecast, Inc., Manco Products, Inc., Martin Grinding & Machine Works, Permanent Mold Die Co., Productive Equipment Corp., Pangborn Corp., Precision Metal Molding, Prospect Die and Mold Co., Rebmann Products, Reed-Prentice Div., Package Machinery Co., Rex-Buckeye Co., Frederick B. Stevens, Inc., Triulzi, S.A., Univertical Corp., U. S. Reduction Co.

Active direction of the exposition and congress is in the hands of: John L. MacLaren, chairman, sales engineer Aluminium Ltd. Sales, Inc.; Arthur M. Clark, exhibition manager, manager of Foundry and Plant Engineering, Ford Motor Co.; Harry D. Hall, program chairman, director of Process Development, General Motors Technical Center; David C. Salatin, program vice chairman, head of the Metal Casting Laboratory, General Motors Technical Center; Malcolm A. Nicholas, publicity chairman, president Manco Products, Inc.; Arthur Linzell, registration chairman, Detroit district manager for Hydraulic Press Mfg. Co.; and Ralph C. West, housing chairman, sales engineer, Aluminum Co. of America.

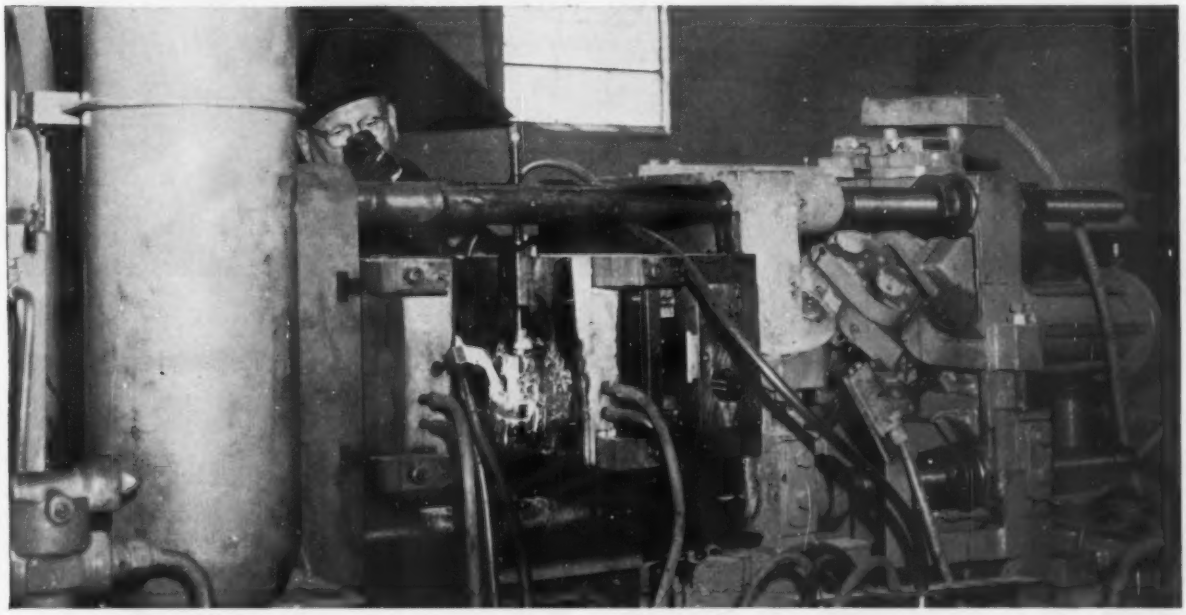
more industry news, page 72

MACLAREN CLARK HALL SALATIN NICHOLS LINZELL WEST

SAVE ON SHORT RUN DIE CASTINGS!

CHANGE DIES IN MINUTES!

With D-M-E Standard Unit Dies for Zinc or Aluminum Die Casting



Cut Die Costs and Save Time with Stock Replacement Units

DIE CHANGES that normally take 3 to 5 hours are done in minutes with D-M-E's Standard Unit Dies for zinc or aluminum die casting.

Standard interchangeable Replacement Units are *in stock* now to reduce your die costs and shorten delivery schedules.

D-M-E's Standard Unit Die assembly offers these unique features for added savings in production time and maintenance:

Construction permits complete freedom on *three sides* of the cavity for placement of cores or cooling lines; six sturdy leader pins and bushings provide accurate alignment and trouble-free performance; and "quick change" wedge clamps for positive positioning of each plate.

Standard Replacement Units are quickly positioned in the Unit Die Holder by a precision T-slot in the mating edge of the plates; there is no interference with the cavity layout.

Whether you require rack and pinion or automatic "bumper-type" ejection, D-M-E has a Standard Unit Die to fit the machine.

D-M-E Unit Die Holders are available for Standard 10″ x 12″ or 12″ x 15″ Replacement Units.

Start saving *now* on your short-run die-casting jobs with D-M-E Standard Unit Dies.

SEVEN BRANCHES FOR FASTER SERVICE

Write **TODAY** for Complete Specifications

DETROIT MOLD ENGINEERING COMPANY

DME

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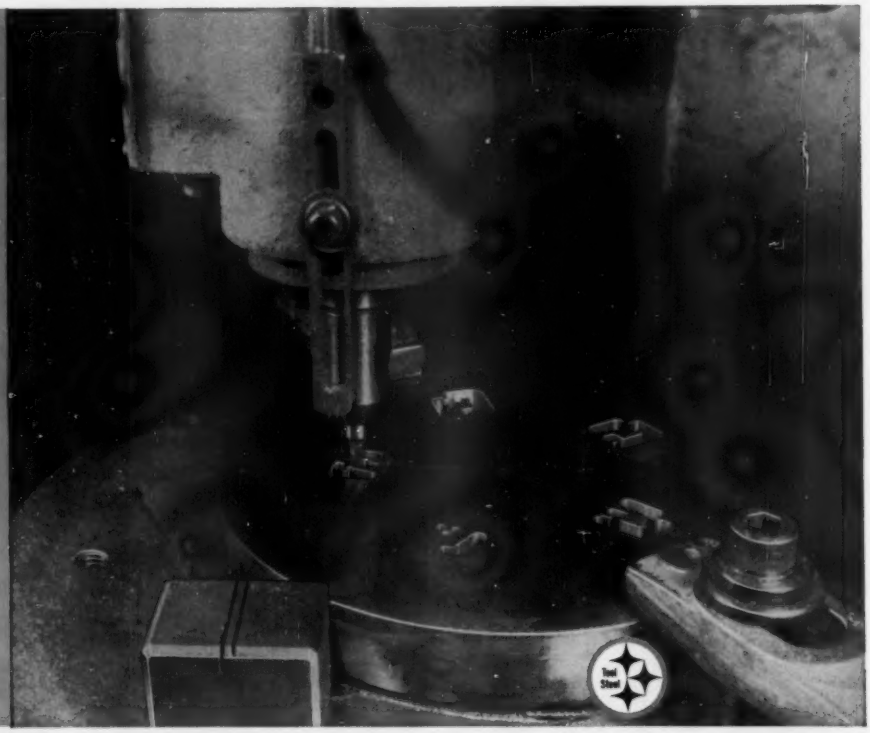
- D-M-E of CANADA, Inc., TORONTO, ONT.: 156 Norseman Ave.

Circle No. 21 on Reader Service Card

Latrobe's EXTRUSION TOOL STEELS



Dependable... easy to machine... readily available in the size you need!

When your extrusion schedule calls for fast delivery of a die steel to do the job, you can cut production time by calling your nearby, fully-stocked Latrobe steel service center for prompt attention. Whether for regular run production or specialized application, there's a Latrobe grade and size practically at your fingertips.

Latrobe's Extrusion Tool Steels are always dependable... easy to saw, file and machine ... Reflectoscope inspected to guarantee internal soundness ... made to give you the kind of extrusion production service you want!

Wide range of stock sizes available in these grades:

- **LPD** • Type H-12 die steel
- **VDC** • Type H-13 die steel
- **VISCOUNT 20** • free-machining Type H-13 die steel
- **VISCOUNT 44** • prehardened, machinable Type H-13 die steel

Call your Latrobe steel service center today for prompt service and technical assistance... or write for literature about individual grades.

MEMBER OF ALUMINUM EXTRUDERS COUNCIL

Skillfully made in U.S.A. by...

LATROBE Metalmasters

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

BRANCH OFFICES and STEEL SERVICE CENTERS: BOSTON • BUFFALO • CHICAGO CLEVELAND • DAYTON • DETROIT • GRAND RAPIDS • HARTFORD • LOS ANGELES • MIAMI MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN LEANDRO • TOLEDO YOUNGSTOWN

Circle No. 82 on Reader Service Card

From a laboratory furnace to a reverberatory furnace Hevi-Duty helps you find the value solution to your non-ferrous melting problems

Hevi-Duty's value solutions to three melting problems are described below. Such solutions call for comprehensive industrial engineering ability as proved by Hevi-Duty's success in solving thousands of heat processing problems in all types of applications.

Such solutions call for creative design engineering ability backed by Hevi-Duty's experience with industry's most complete line of electric and fuel-fired furnaces and ovens. (Where stock designs or adaptations won't do, Hevi-Duty custom-engineers equipment including huge field-erected furnaces.)

Such solutions call for soundly built and tested equipment typified by Hevi-Duty furnaces now paying off throughout industry in increased production and extended economic life of equipment.

Case histories by the hundreds testify that it makes profitable sense to call in your Hevi-Duty sales engineer to help find the value solution to your melting problems.

HEVI-DUTY

Electric and Fuel-Fired Industrial Furnaces and Ovens

B P C

A Division of Basic Products Corporation

Hevi-Duty Electric Company, Milwaukee 1, Wis.

Hevi-Duty G-05 laboratory furnace used by Great Lakes Steel Corp., Detroit, for determining alumina content of slag is kept at 2200°F, 24 hours a day, 7 days a week. It heats rapidly, has 48 steps of control between 1700°F and 2600°F. Instruments and controls in base remain close to room temperature. **For more information please request Bulletin 254.**

Double-chamber dry-hearth aluminum melting furnace covers only 32 sq. ft. area at In-Sink-Erator Co., Racine, Wis., yet melts and holds up to 400 pounds of aluminum per hour after 2½-hour warm up. Well insulated furnace permits use of a permanent mold machine next to the dip-out chamber. **For complete information write for Bulletin 593.**

Each of these reverberatory furnaces melt and hold 35,000 lbs.. of aluminum for direct-chill billet casting. One furnace brings melt up to temperature while other pours. Large doors permit easy bath access for charging, drossing, fluxing, alloying and furnace cleaning. **Please write for Bulletin 591.**

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We make them all!

Now, *from stock*, you can obtain longer-lasting *steel* goosenecks* in nominal sleeve sizes for your die casting machines. Dodge goosenecks are machined and sleeved, ready for your use.

Shown here are just a few of the hundreds of Dodge *cast steel goosenecks* we have supplied to industry.

Select the one that fits your machine—then ask us for an eye-opening quotation! If your gooseneck isn't pictured here, ask. Chances are we've made it and it's available. Cast steel replacement parts, from pots to skimmers, are in stock, too.

Write us *today*. We'll be happy to furnish complete details, without obligation.

* *Users report better than 4-year service life!*

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THE MOST IMPORTANT ALLOY IN A STEEL CASTING IS QUALITY

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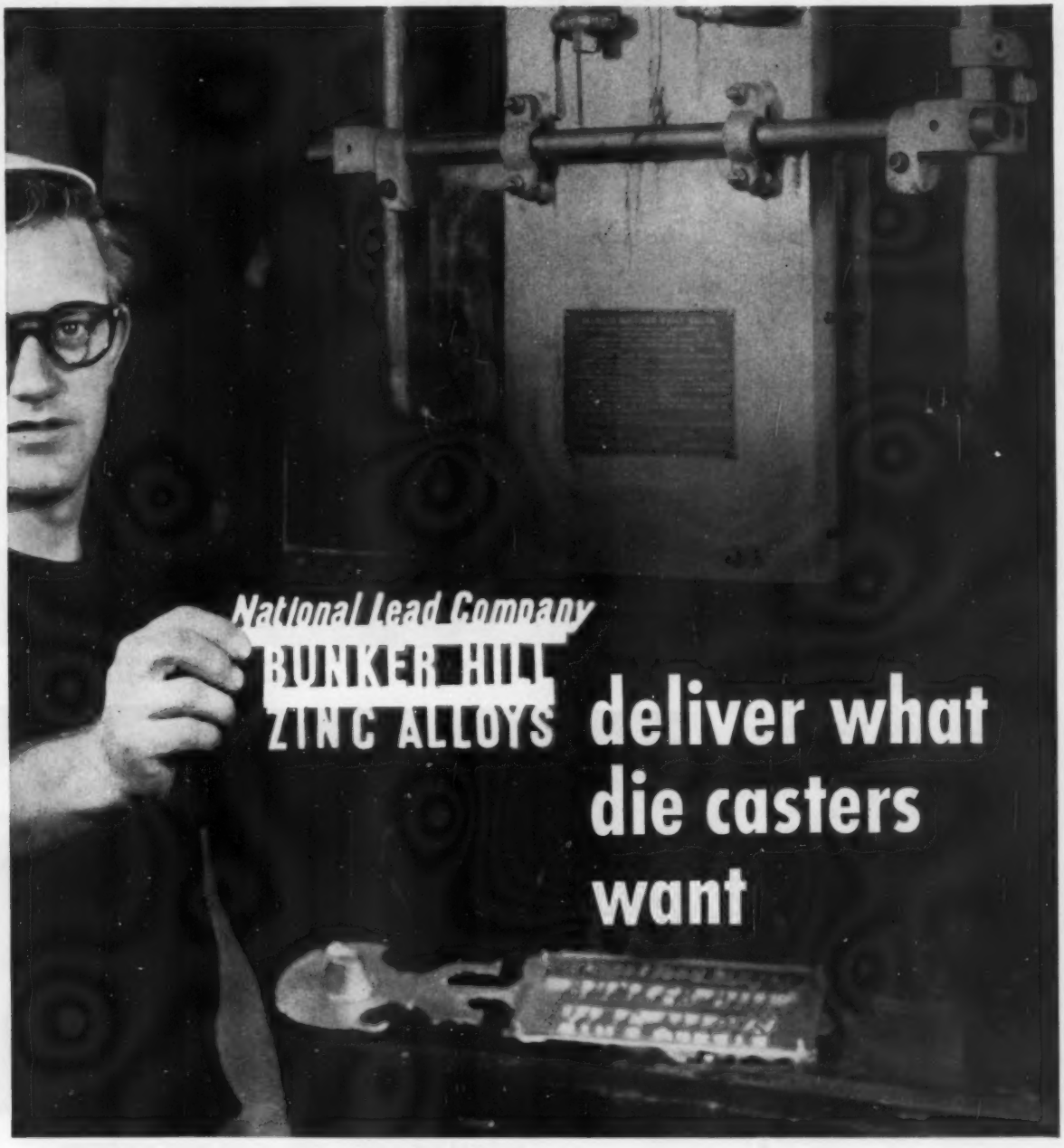

Whatever you want in zinc alloys you get in *National Lead* Bunker Hill Zinc Alloys.

They're exceptionally pure. In fact, they more than meet ASTM and SAE specifications for freedom from contaminants.

You can count on *National Lead* Bunker Hill Zinc Alloys to give you sound, high-strength, porosity-free castings that require very little machining. What's more, they trim, punch, tap and broach cleanly . . . plate with little or no preparation . . . help you maintain fast, continuous production on all machines . . . and cut rejects to the bone.

Remember, the fastest forming process — from metal pig to manufactured part — is at its best only with the finest alloys. *And those are National Lead Company* Bunker Hill Zinc Alloys. When you need them — call us.

National Lead Company

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New York 6, N. Y.

Offices in principal cities

Circle No. 40 on Reader Service Card

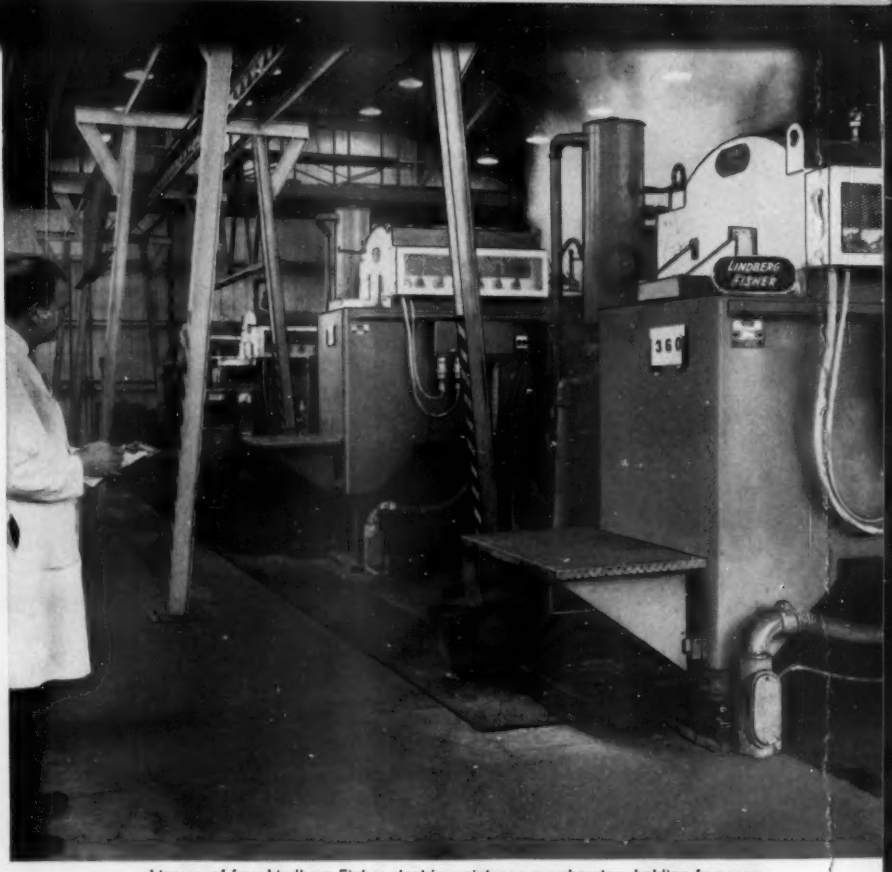
When you apply heat to aluminum Lindberg can give you the right help

If your product requires the application of heat to aluminum, you can safely look to Lindberg for the equipment and methods to do the job best. Anywhere along the line from the ingot to the finished product, Lindberg-Fisher equipment and broad experience can meet every need.

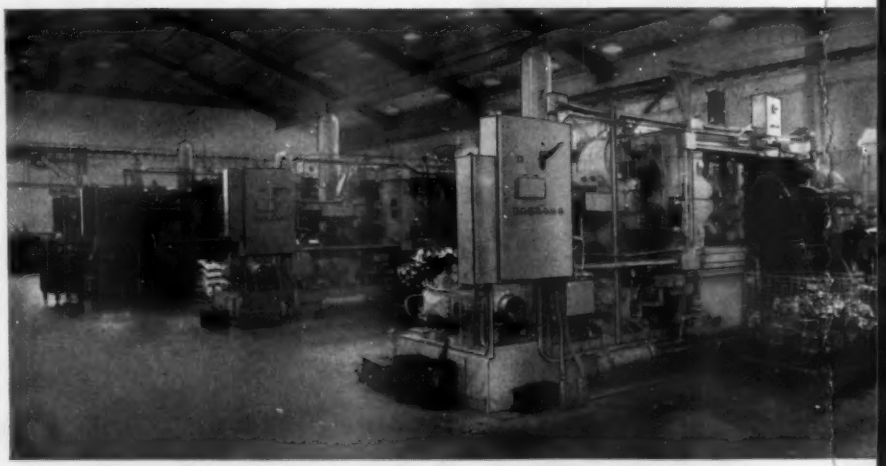
With its long-time background in all phases of heat to industry our engineering staff has standout knowledge of the hows and whys of aluminum melting, casting and treating. Over the years this staff has been responsible for many of the most important developments in the field.

For instance, the technique of putting a cast lining in induction melting furnaces to provide lower initial and maintenance cost . . . the Lindberg Autoladle, the first practical automatic ladling unit . . . the two-chamber induction melting furnace . . . and many other practical innovations. This is why our aluminum processing experts, such as Ray Dunn are frequently consulted in an advisory capacity on aluminum treating problems.

Since we cover all types of equipment for melting, holding or treating aluminum, you can depend upon us to recommend objectively the most suitable procedures and equipment to fit your requirements. Get in touch with your local Lindberg Field Engineer (see your classified phone directory) or write direct to: Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard St., Chicago 12, Ill.



Line-up of four Lindberg-Fisher electric resistance reverberatory holding furnaces at McCulloch Corporation. Die casting machines are just behind each furnace.

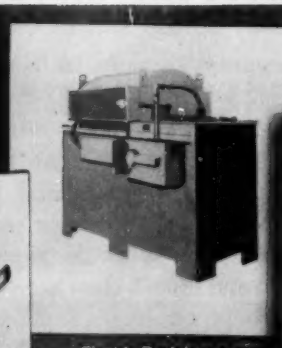


Line-up of four die casting machines at McCulloch Corporation. Lindberg-Fisher Holding Furnaces are just behind each machine.

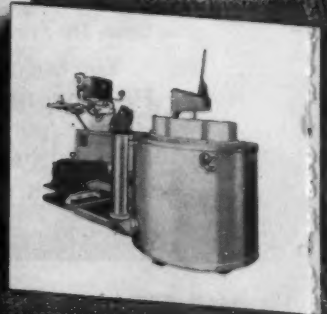
THERE'S LINDBERG EQUIPMENT FOR EVERY INDUSTRIAL NEED

These are representative units from complete Lindberg lines in all types of industrial heating equipment.

The Lindberg Autoladle



Electric Resistance Aluminum Holding Furnace



Cyclone Heat Treating Furnace

THE RIGHT COMBINATION FOR DIE CASTING EFFICIENCY...LINDBERG FURNACES AND AUTOMATIC LADLING

Die casting efficiency at the McCulloch Corporation, Los Angeles, California, has been gratifyingly increased with the new installation of four Lindberg Electric Resistance Reverberatory Holding Furnaces equipped with Lindberg's automatic ladling unit, the Autoladle. These holding furnaces, with 2000 lbs. molten aluminum capacity, are spotted adjacent to four die casting machines. Molten aluminum is delivered to the furnaces by monorail and held at the precise temperature required by the casting station. The precise shot is delivered automatically to the die casting machine by the Lindberg Autoladle. This installation is used primarily for casting parts for McCulloch-Scott outboard motors.

In any production process where aluminum needs heat there is Lindberg equipment to apply it most economically and efficiently, and Lindberg experience to fit this equipment most ideally to your product and production requirements. Furnaces for melting and holding, casting stations, re-melting or heat treating are available in all capacities, electric or fuel fired. Get in touch with your Lindberg Field Engineer (see your classified phone book) or write us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard St., Chicago 12, Illinois. Los Angeles Plant: 11937 South Regentview Ave., Downey, California. In Canada: Birlefco-Lindberg, Ltd., Toronto.

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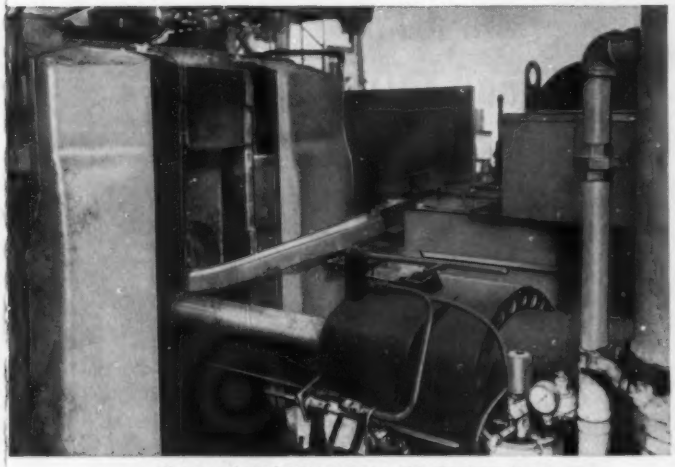
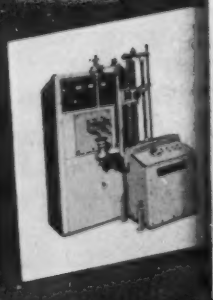


Precise shot of proper temperature aluminum is automatically delivered from conveniently located holding furnace to die casting machine by Lindberg Autoladle.

Housings for McCulloch-Scott outboard motors, shown here, are representative of the type of castings Lindberg equipment helps McCulloch produce.

High Frequency Unit with Zone Scanner



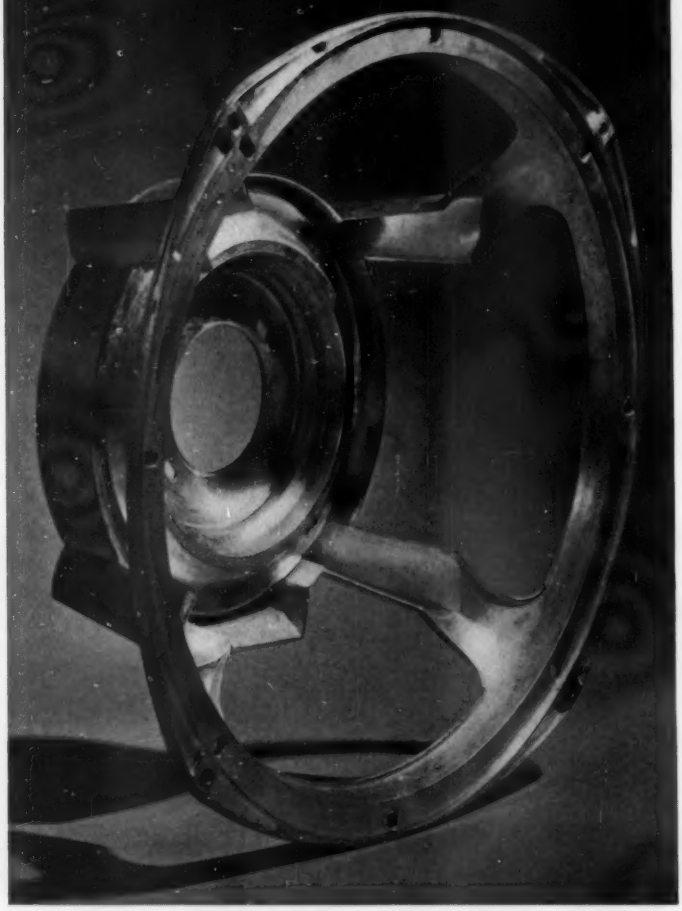
Large Aluminum Melting and Holding Reverb.

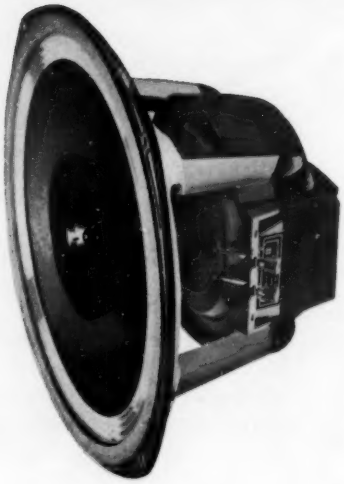
Laboratory Box Furnace

Periodic Ceramic Kiln

350 KW Induction Melting Furnace

IT'S LIGHTER THAN YOU THINK!





IMPROVES ACOUSTICS and CUTS ASSEMBLY COSTS WHEN DIE CAST with ZAMAK

This zinc die cast "basket" for the UNIVERSITY Model 312 Diffaxial 3-way High-Fidelity Speaker provides the improved design and production economies necessary for outstanding performance characteristics and moderate price of this newly designed speaker, made by University Loudspeakers, Inc.

Formerly an assembly of steel stampings, this one-piece design contains supports, flanges, slots, ribs, holes, studs and channels for permanent centering and mounting of the cone, magnet pot assembly and other components. Expensive spinning and other machining operations are eliminated and final speaker assembly requires fewer steps, resulting in significant production economies.

First prize winner in our "Lighter Than You Think" die casting contest, this frame weighs only 2 lbs. 12 oz. and measures 13" across corners. It is 4⅝" deep and has a minimum wall thickness of .040". The thin-wall, hollow struts are designed to offer minimum sound reflecting surfaces while providing the extreme rigidity required for mechanical stability of the entire structure. There is no loss of magnetic energy in this speaker since zinc is non-magnetic.

HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

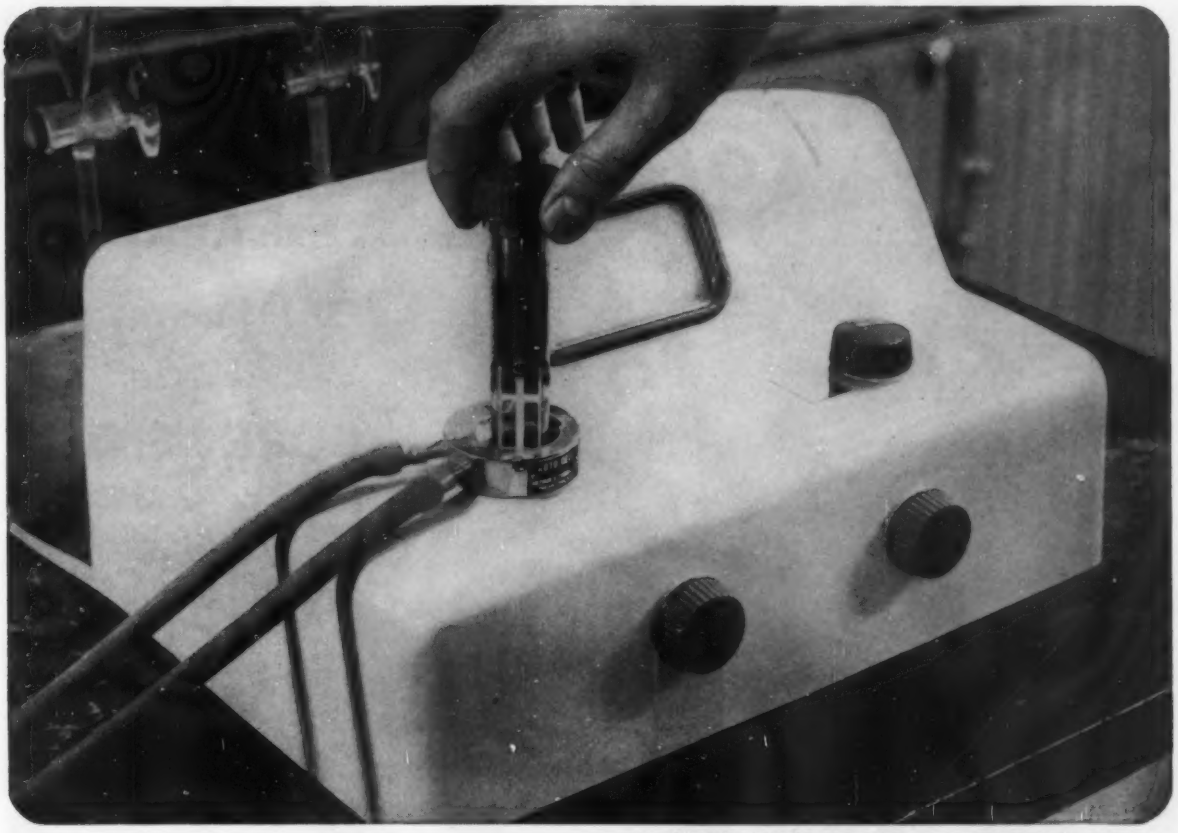
DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

160 Front Street • New York 38, N. Y.

HORSE HEAD PRODUCTS ®

Circle No. 42 on Reader Service Card

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



COLORIMETER (inherently extremely accurate) determines percentages of molybdenum, tungsten, cobalt and manganese in A-L tool steel to insure consistent, high quality.

Colorimeter measures exact chemical composition of Allegheny Ludlum tool steel melts

Accurate adjustment of alloys guarantees uniform heat treatment, predictable dimensional changes, reduced grinding, standardized machining operations.

Close control of molybdenum, tungsten, cobalt and manganese is at the heart of a good tool steel melt. In addition to the usual testing methods, Allegheny Ludlum's chemical laboratory checks these metals with Colorimetry because of its inherent, extreme accuracy.

On the basis of the Colorimeter's findings, it is possible to make carefully calculated furnace additions of ferro-alloys, insuring precise control over chemistry. This guarantees your receiving the *exact* analysis order after order, providing *uniformity of heat treatment, predictable dimensional changes, reduced grinding and standardized machining operations.*

WBW-7262

Colorimetry is but one step toward careful control over composition. Allegheny Ludlum also sets exacting purchasing specifications on raw materials and scrap. Quality Control checks all incoming orders to see that they conform with these specifications. Another guard toward your getting your exact specifications: each ingot bears a metal tab showing heat number.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. PM-5

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

Circle No. 5 on Reader Service Card

V-R Tantung Investment Castings...

for resistance to HEAT... WEAR... CORROSION

These Tantung Investment castings have effectively overcome the problems resulting when complex parts are subjected to heat, abrasive wear and corrosion. Vascoloy-Ramet Tantung . . . our exclusive cast alloy . . . has: fine grain structure, toughness, low coefficient of friction and high transverse rupture strength making it ideal for these typical applications. The V-R investment casting process exactly reproduces small, intricate shapes in large quantities for use in many quality products. V-R metallurgists will be glad to study your application. Just send us the details of your problem and enclose a parts drawing.

V-R VASCOLOY-RAMET

CREATING THE METALS THAT SHAPE THE FUTURE

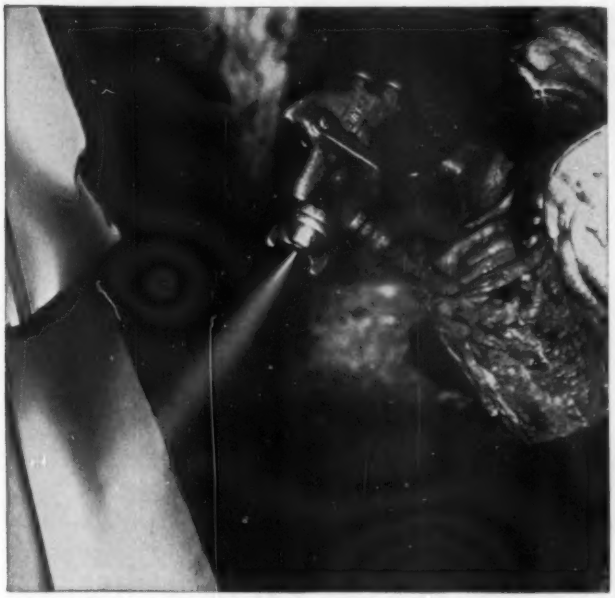
812 MARKET STREET • WAUKEGAN, ILLINOIS

Circle No. 51 on Reader Service Card

I-788

SUPERIOR CASTINGS, EXTRUSIONS, TRACED TO USE OF ACHESON COLLOIDAL GRAPHITE

The excellent lubricating properties of these materials have been proven under the severe conditions attendant to aluminum permanent molding and extruding. In the specific examples described below, smoother surface finishes, longer die life, and more uniform metal flow are chiefly attributed to the application of a 'dag' brand dispersion.



Fewer rejects, consistently higher quality castings are obtained at Paragon Aluminum Corporation by spraying 'Prodag' on their permanent molds as a pre-pour wash.

Better surface finish with Prodag® permanent mold coating is just one of the reasons why Paragon Aluminum Corporation, a Division of Detroit Harvester Company located at Monroe, Michigan, switched to this Acheson product. After four years of experimentation with other mold washes, Paragon chose 'Prodag' — Acheson semi-colloidal graphite in water — and has used it constantly the past seven years. The reasons for its choice are these: uniform consistency, excellent heat-transfer quality, and its hard, smooth, tenacious film which resists flaking and provides easier parting characteristics.

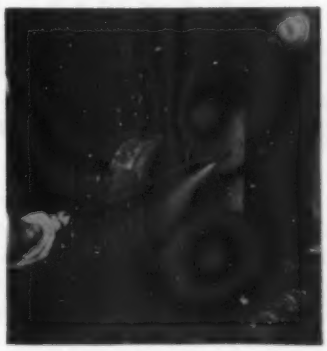
With about 95 per cent of its annual output of more than two million pounds of castings going to the automotive industry, Paragon must insist upon quality. 'Prodag' helps to maintain this standard. Parts for convertible automobile tops are precision-molded from both 355 and 319 aluminum alloy. Molds are pre-heated before each day's run to 600° F. and the casting cycle maintains this temperature. The 'Prodag' dilution ratio is 1 to 4 parts water and is applied to the molds with a commercial spray gun. Aside from occasional touchup at points of greatest wear, this coating lasts through the entire run. Because of the physical contours involved in these comparatively small, light castings, they require rapid cooling in certain areas to insure uniform strength. The 'Prodag' coating — with its proven fast heat transfer ability — allows the castings to cool without breaks or pinholes. And by parting more easily, the high-finish castings which result have given Paragon Aluminum products wide acceptance in this demanding industry. If you have a metal casting problem, write direct for additional information contained in our Bulletin No. 425. Address Dept. PM-50.

'dag', 'Aquadag', and 'Prodag' are trademarks registered in the U.S. Patent Office by Acheson Industries, Inc.

FASTER APPLICATION, LESS MATERIAL USED IN THIS EXTRUSION APPLICATION

Aluminum Extrusions, Incorporated, of Charlotte, Michigan, has realized a 30% savings in their material handling costs by the use of Aquadag® — Acheson colloidal graphite in water. They formerly had used an oil-graphite mixture which required a dilution ratio of 16 lbs. of graphite to a 55 gallon drum of oil. It was too slowly applied by swab and too coarse to effectively apply by spray.

With 'Aquadag', Aluminum Extrusions has a lubricant that is finer in particle size, permits wider coverage, and provides greater "sprayability". These minute particles pass freely through the spray nozzle, eliminating the costly downtime formerly involved in cleaning clogged equipment. The tough, dry film 'Aquadag' forms upon the evaporation of its water carrier, doesn't smoke or react when applied to hot dies and metals. This improves working conditions as well as extends die life. Important also to both die surfaces as well as the finished extrusion, is the fact that this durable, low-friction film allows easier, more uniform metal flow.



Acheson 'Aquadag', applied on die surfaces provides faster, more uniform application for Aluminum Extrusions, Incorporated.

If your problem is more effective lubrication under normally adverse conditions of extreme temperature, pressures, or abrasions, call in Acheson. In the meantime, write for your free copy of Bulletin No. 426.

ACHESON

dispersions digest reporting uses for

dag® BRAND DISPERSIONS

ACHESON **Colloids Company** PORT HURON, MICHIGAN

A division of Acheson Industries, Inc. Also Acheson Industries (Europe) Ltd. and affiliates, London, England

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My answer for fire-resistant fluids is... UCON Hydrolubes

Q. WHAT FIRE-RESISTANT HYDRAULIC FLUID SHOULD YOU USE?

UCON hydrolubes are the economical answer for fire-resistance in hydraulic fluids. Extensive field tests and more than 10 years of routine use in industrial hydraulic equipment have proven the safety and economy of UCON hydrolubes. And, UCON hydrolubes are approved for use by Factory Mutual Laboratories.

• UCON hydrolubes have better viscosity-temperature properties than the phosphate-ester fluids, that cost as much as 40 per cent more. UCON hydrolubes are shear-stable. And, they have none of the harmful effects on packings and seals that the phosphate-esters exhibit.

• UCON hydrolubes provide maximum protection against liquid and vapor phase corrosion, and have outstanding anti-wear characteristics. Thus, pump replacement costs are held to a minimum. Cheaper water-in-oil emulsions have poor emulsion stability. In addition, water-in-oil emulsions lose fire-resistant properties and give inadequate lubrication.

• Most hydraulic systems can be quickly and easily converted to fire-resistant UCON hydrolubes. Standard flushing and refilling procedures, involving a minimum of time and effort are sufficient. In many instances, reduced leakage losses have been reported.

Remember—UCON hydrolubes are the economical answer for fire-resistance in hydraulic fluids. Replacement is quick and easy and loss is low.

Get all the facts on UCON hydrolubes in the booklet, "UCON Hydrolubes Spell Safety." For a copy ask a CARBIDE Technical Representative; or write Union Carbide Chemicals Company, Room 328, Department J2, 30 East 42nd Street, New York 17, N. Y.

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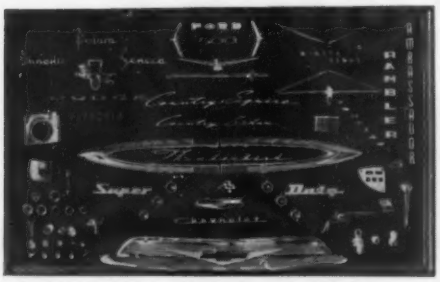
UNION CARBIDE CHEMICALS COMPANY / DIVISION OF UNION CARBIDE CORPORATION

Circle No. 66 on Reader Service Card

50 million castings a year from these

PUTTING THE NEW CARS IN TRIM FOR READY SALES

At TRILEX MANUFACTURING CO., Wayne, Mich., this efficient battery of 14 KUX Hot Chamber Die Casting Machines (400- and 600-ton) is part of the complete Trilex facilities for modern die casting, fully automatic plating, finishing, and assembling.



KUX die casting machines

"THE PRIMARY concern of the major automobile manufacturers for die-cast trim parts is *quality*," says John Airey, president of Trilex Manufacturing Co., important suppliers in the automotive and appliance field. "That's why we have used KUX Die Casting Machines since 1945. They produce hardware finish quality castings.

"But along with quality," Mr. Airey continues, "auto makers as well as appliance men consider *price*. We've found that KUX machines can be depended on for minimum maintenance and minimum downtime. They put us in a better position to compete on a cost-per-unit basis."

Whether your main concern is lower production costs, higher quality or both, investigate the advantages of KUX Die Casting Machines. 28 all-new strain gauge proven KUX models, 50 to 2000 tons, for both hot or cold chamber operation, available with automatic cycling mechanism and KUX patented "Vac-U-Die" and "Auto Feed" systems of vacuum die casting.

Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.

KUX MACHINE CO.

6725 North Ridge Avenue, Chicago 26, Illinois

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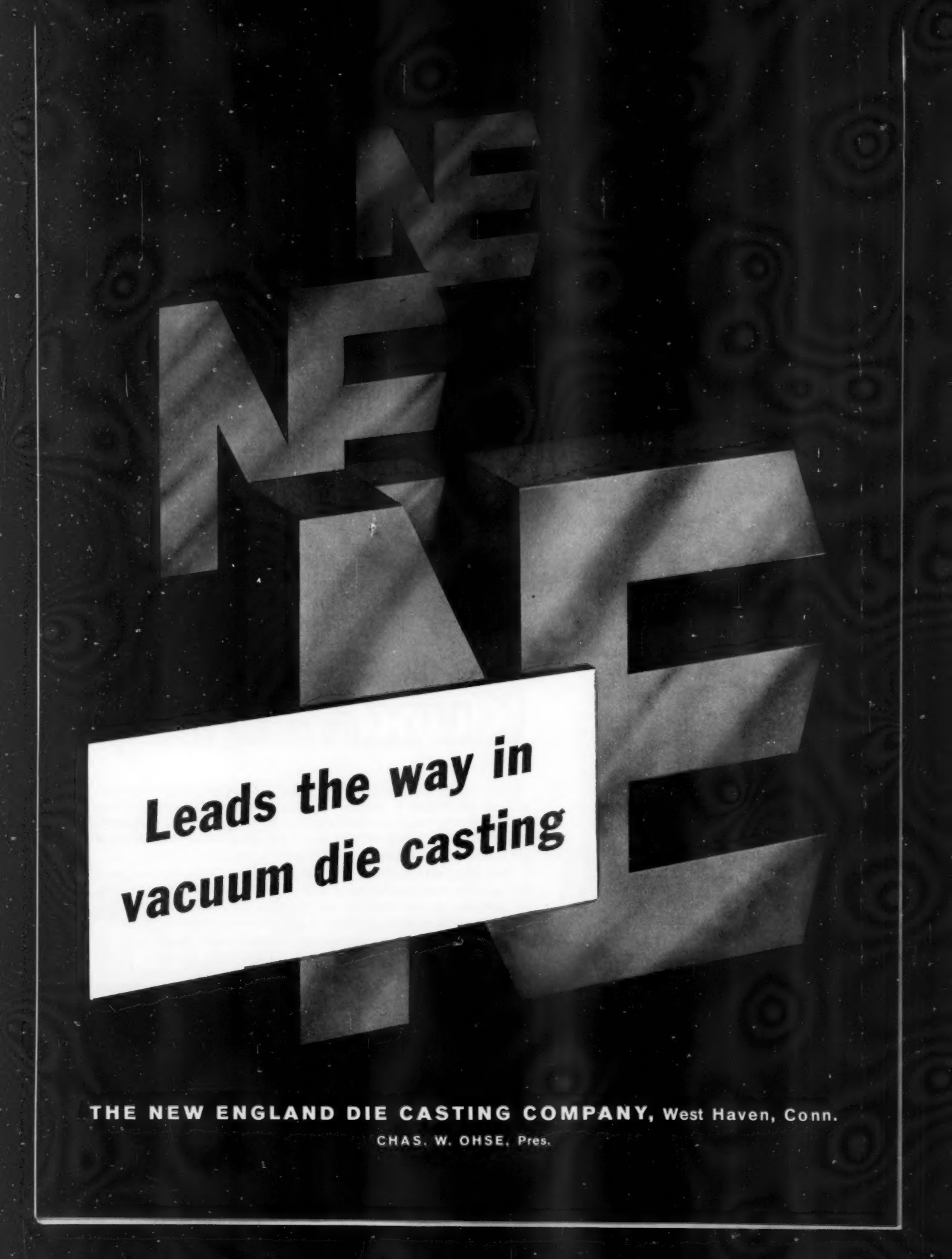


THE NEW ENGLAND DIE CASTING COMPANY, West Haven, Conn.

CHAS. W. OHSE, Pres.

New Design Concepts

MODERN METAL POWDER PRESSES

widen the design field, lower manufacturing costs

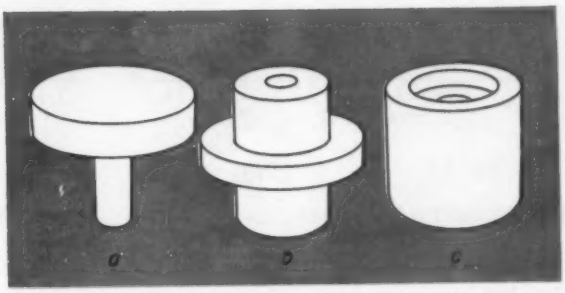


FIG. 1 THREE IMPOSSIBLE parts? With modern presses they can be made.

TODAY, the design engineer can call for, and get, parts made from metal powders which were impossible to mold just a few years ago. This has come about largely through the advances which have been made in the design, speed, and versatility of the presses used to form green compacts.

MORE COMPLEX SHAPES

Three typical parts are shown in figure 1. Part 1a couldn't be made because of the very great difference in diameter of the two cylindrical elements. The density of the flat, large diameter, thin top and the small diameter, long stem would have been so different that serious warpage and varying dimensional changes during sintering would have resulted in high scrap losses. To get a reasonable number of good pieces, held to only moderate dimensional tolerances, would have required either coining after sintering or the part would have been made with a large diameter stem which had to be machined to size. Either of these options increased manufacturing costs to such an extent that the economy of powder metallurgy could be lost.

Today, with proportional pressing, this part is easily made and all elements of the part will have the same mechanical and physical properties. Tolerances can be held without excessive costs due to secondary operations. The sequence of pressing operations which lets the fabricator make this piece are shown in figure 2a.

Part 1b couldn't be made because the centrally located flange would prevent ejection unless very expensive and complex tooling were used. The flange would have been machined into the tooling with a loose piece above it to maintain shape and size. The only way pressure could be applied to the flange was literally in a somewhat hydrostatic manner. The density of the flange would be low and rejects high.

Of course, the part could be made by extending the flange to the top of the piece and machining afterwards. This might destroy any economy resulting from the use of metal powders.

Now, parts of this general type are commonly made because presses with multiple upper and lower

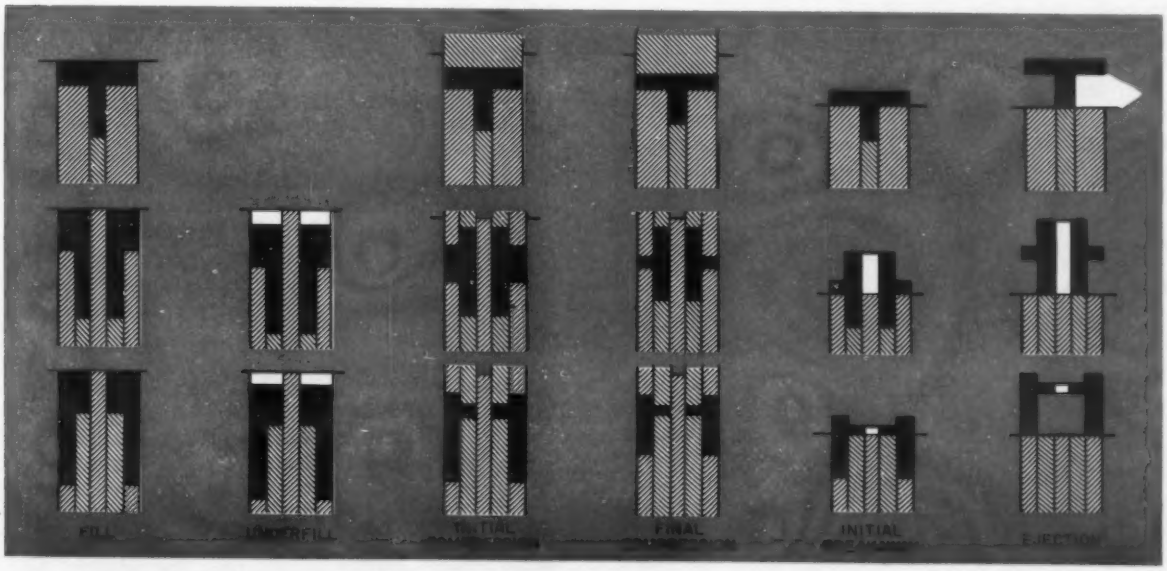


FIG. 2 HERE'S HOW modern presses make the parts shown in figure 1.

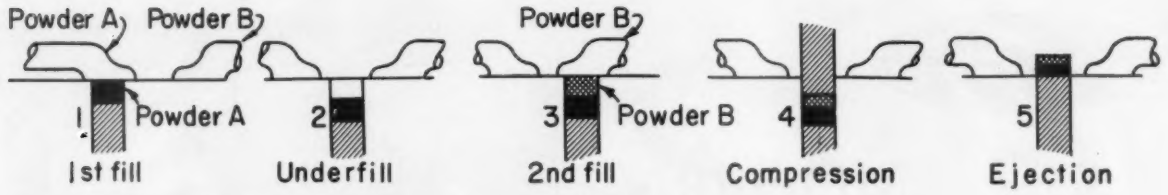


FIG. 3 BIMETALLIC COMPACTS can be made on presses fitted with two feed shoes.

punches have been built. These various punches are independently controlled and can be set to cycle automatically. Uniform density parts are made, and the economy of powder metallurgy is not lost. Figure 2b shows the sequence of pressing operations required to make this part.

Part 1c would have required a second machining operation to get the recess in the top and the internal flange. Now it's pressed to final shape by the operations shown in figure 2c with no loss in the basic economy of the powder process.

BIMETALLIC PARTS

Bimetallic parts could always be made, but the operation was slow. Generally the charges of powder had to be measured out separately and the die loaded manually. The only cases where it was economical

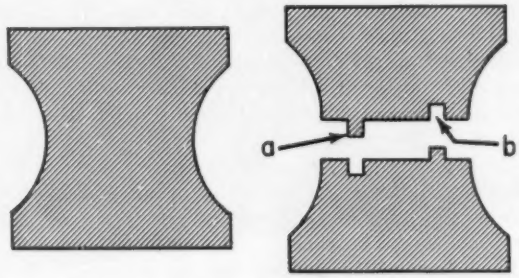


FIG. 4 SINTER BRAZING makes this impossible part possible.

to make bimetallic parts this way were those where costs were so high by other methods that even this slow, laborious method showed some economy.

Modern presses can be fitted with multiple feed shoes and variable depth of fill so that bimetallic parts can be made almost as rapidly as single metal parts. The sequence of filling operations is shown in figure 3. The movement of the various feed shoes and the lower punch can be set on a repetitive cycle so that these parts are made entirely automatically.

LARGE AREA PARTS

To get the economy possible with powder metallurgy, the green compacts have to be pressed rapidly. This means that mechanical presses had to be used, but press capacities over 100 tons just weren't available. Now, mechanical presses of at least 200-tons capacity are being built. With these presses the size of the parts which can be made is greatly increased, generally more than doubled.

In addition to the higher pressures and higher cycling speeds of these presses, they can accommodate much larger tooling. For example, a large diameter bushing might have only a small projected area, but require such massive tooling it could not be made by the available presses. The new mechanical units will handle many of these extra large parts.

Along with increased capacity the depth of fill on the larger presses has been increased. This permits longer parts to be made than were ever possible before. Then the multiple ram actions, the floating die, and the floating core rod add flexibility.

The hydraulic presses have not quit the field in favor of mechanical ones. Where very large units are needed and when very high pressures must be used, hydraulic presses are still required.

Improvements in hydraulic circuitry, new, faster acting valves and other components, and better guidance methods have permitted the manufacture of presses for powder metallurgy work with capacities up to at least 3000 tons and cycling speeds as high as 80 complete cycles per minute.

With these large, high speed presses it is possible to press parts much larger than were ever possible before. At present, these hydraulic presses do not have the multiple ram movements which are available in mechanical presses. For the more complex parts, therefore, the required movements must be built into the tooling. This increases the piece costs when higher tooling charges must be amortized, but the saving in machining is frequently so great that even with this increased cost, powder metallurgy is still economical.

SOME DESIGN DON'TS

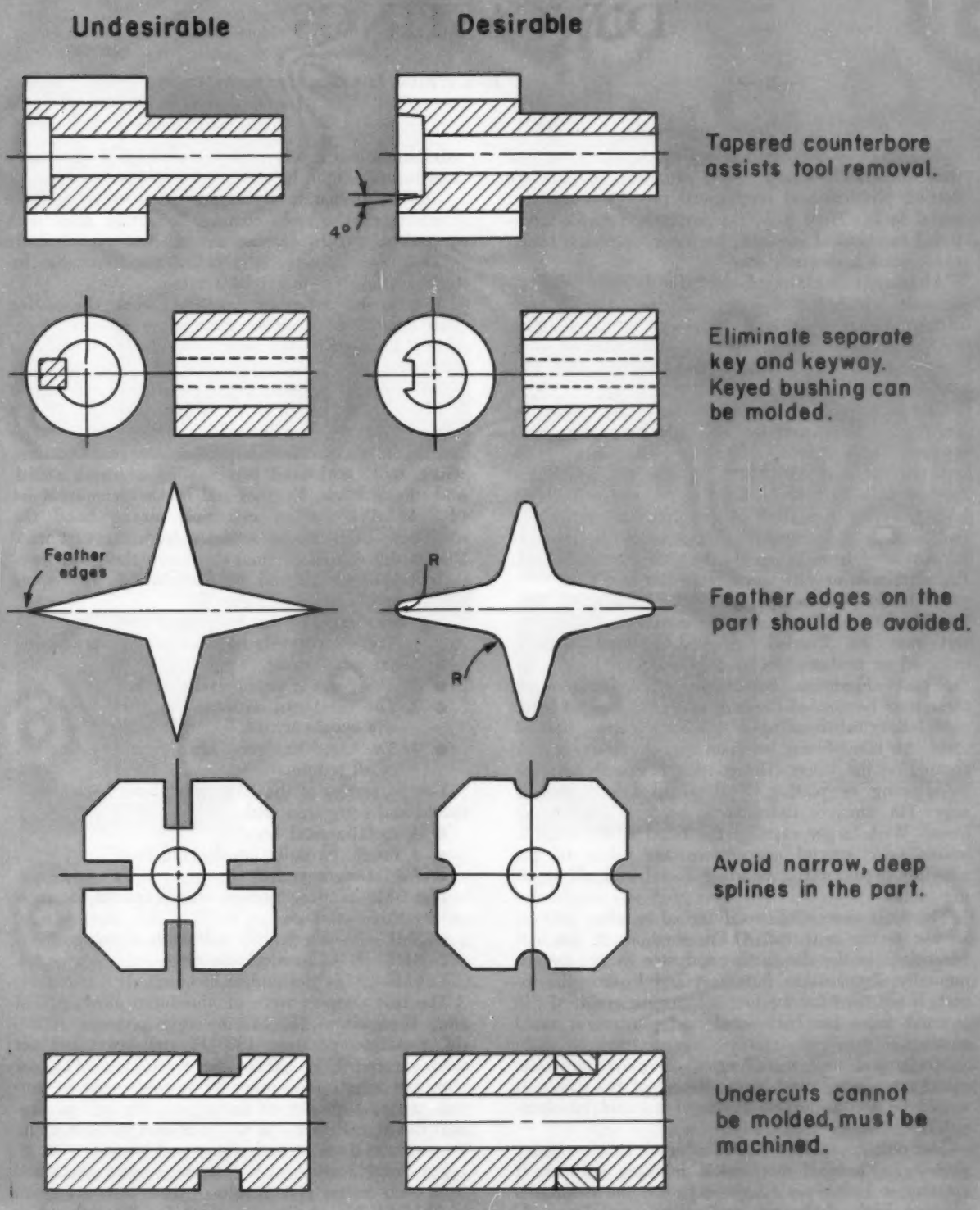
One thing the designer should remember. Through the use of very complex tooling it is possible to make some of these parts which are generally not recommended. For such parts, tooling is very expensive and production rates are low. But if the cost of manufacture by other methods is excessive it is possible that powder metallurgy might be used.

Bear in mind also that the versatility of modern presses combined with the technique called sinter-brazing permits the making of extremely complex parts with all of the economy of powder metallurgy, figure 4.

Not every fabricator has all of the different press equipment which has been discussed. Neither is every fabricator sufficiently skilled to make up complex parts by sinter-brazing. A little shopping around will generally turn up a fabricator of parts who can make the part you want and do it economically.

Contributors to this article are: Baldwin-Lima-Hamilton Corp.; Fawcett Preston & Co., Ltd.; Kux Machine Co.; and F. J. Stokes Corp.

Some Design Pointers For Sinterings


Undesirable
Desirable
4°
Tapered counterbore assists tool removal.
Eliminate separate key and keyway. Keyed bushing can be molded.
Feather edges
R
R
Feather edges on the part should be avoided.
Avoid narrow, deep splines in the part.
Undercuts cannot be molded, must be machined.

New Design Concepts

A new interlocking bond which holds . . .

CAST IRON INSERTS IN ALUMINUM DIE CASTINGS

By A. F. BAUR, *Asst. Gen. Mgr.; and* J. S. MIKUS, *Project Engineer, Doehler-Jarvis Div., National Lead Co.*

INSERTS in die castings widen the range of end uses. Separately made inserts are used to give the casting physical and mechanical properties the cast metal lacks. They may, for instance, provide additional mechanical strength, hardness, corrosion resistance, wear resistance, etc.

Aluminum cast around an insert forms a bimetallic unit, which has the physical properties of both metals. An example is the aluminum engine block with cast iron cylinder sleeves. The aluminum is light and has excellent heat transfer properties. The cast iron sleeve resists wear well.

Cast-in inserts must be firmly held in the casting. Sometimes, the insert is held only by the residual stresses. These develop when the molten metal cools and shrinks onto the insert. This is not a reliable method in a part which must stand severe loads or high temperatures. High temperatures are especially bad because aluminum has about twice the thermal expansion of iron. When the bimetal part is heated, the aluminum may separate from the cast iron.

Mechanical or metallurgical bonds are much better. Mechanical bonds are the commonest. The insert may be knurled, grooved, splined, drilled, crimped or undercut in various ways to lock it in the cast aluminum. Sometimes a combination of these may be needed depending on the type of load.

Metallurgical bonding is used on a very limited scale. An alloy forms between the aluminum and a coating on the insert. The coating is usually applied by dipping or plating. With small inserts this is easy. Tin, zinc, or cadmium is used as the coating metal. With larger castings the bond is not reliable unless very special precautions are taken to get alloying between the bonding metal and the casting metal.

The most successful metallurgical bonding process in use is the patented Al-Fin method. It has not been used in the die casting industry except experimentally. Preparation, handling, and loading the inserts is too slow for the fast die casting cycle. Al-Fin is used more for both sand and permanent mold castings.

Mechanical and metallurgical bonding both demand some machining or processing of the insert. It would be a considerable saving if it could be eliminated.

The outside surface of centrifugally cast cylinder sleeves is an ideal mechanical bonding surface. It appears to be simply rough. Actually, the surface is covered with under-cut projections, see figure 1. Aluminum cast against this surface fills the undercuts and forms a tight, locked bond as shown in figure 2.

Surface preparation for this insert is reduced to cleaning off the mold coating. It can be done with a sand blast or by dipping the insert into a salt bath.

This bond is new. It is called the Bimetallic Interlock Bond or simply BMI bond.

It takes die casting to make BMI work. Die casting puts enough pressure on the molten metal to force it into the undercuts and crevices in the surface of the insert.

An outstanding feature of the BMI bond is that it can withstand high loads in any direction. This is especially important in cylinder linings in engine blocks. Likewise it is important on brake drums, which must withstand combination of axial, radial, and torsion loads. Engines and brakes generate a lot of heat. Without an extremely strong bond the aluminum body would separate from the cast iron. Due to differential thermal expansion the good thermal conductivity would be destroyed. Hot spots would rapidly develop, figure 3.

The advantages of the BMI bond are:

- 1. The insert needs no machining or processing except cleaning.
- 2. The bond is strong and ductile.
- 3. The bond can withstand combined loads of any type.
- 4. The bond has good heat transfer properties at all temperatures.

The properties of the BMI bond have been determined and compared with:

- A metallurgical bond.
- A rough, partially interlocking bond.
- An interference fit.

The BMI bonding surface was prepared for casting by three methods.

1. BMI – S – Electrolytic salt bath cleaning.
2. BMI – C – Chemical cleaning.
3. BMI – M – Mechanical cleaning.

The test samples were of aluminum alloy, ASTM alloy designation SC84A, injection pressure 10,800 psi, metal temperature 1200°F, and insert preheat temperature 575°F. 200 castings were made, 111 cast with test inserts. The other 89 castings were to provide periodic checks on casting quality and to preheat the dies. Figure 4 is a typical cast test specimen. Testing was done in both shear and tension.

For shear testing, two test rings were machined from each casting. The results of these tests are given in Table I. No results are given for the unbonded,

TABLE I
SHEAR STRENGTH TESTS

Type of Bond	No. of Tests	Shear Strength — psi		
		Average	High Value	Low Value
Metallurgical	On Basis of 6	10,770	11,600	5,510
BMI–S	13	19,070	21,550	18,000
BMI–C	12	18,150	19,500	16,350
BMI–M	14	18,280	20,200	16,450
Rough Semi-Interlocking	11	15,940	18,650	12,800

TABLE II
RESULTS OF TENSILE TESTS

Type of Bond	No. of Tests	Average	High Value	Low Value
Metallurgical	12	1,824	2,330	1,300
BMI–S	25	6,290	10,400	4,250
BMI–C	27	7,149	9,880	6,150
BMI–M	30	5,869	7,370	4,760
Rough Semi-Interlocking	12	3,616	4,430	2,980

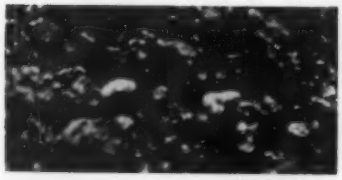


FIG. 1

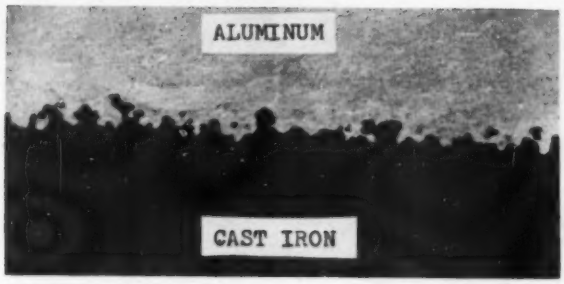
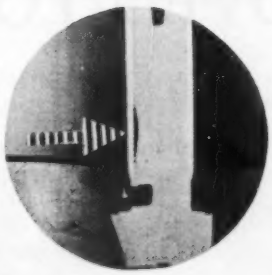


FIG. 2 Bond between aluminum and cast iron.

FIG. 3 Typical bond failure when machined surface without BMI bond is used.



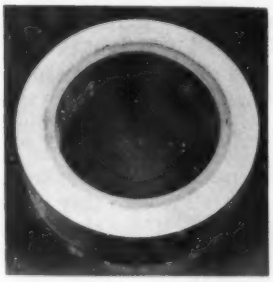


FIG. 4 Aluminum die cast around a steel insert. Note heavy aluminum section compared to steel thickness.

FIG. 5 Results of a sheer test. Note failure in the cast aluminum, not in the bond.

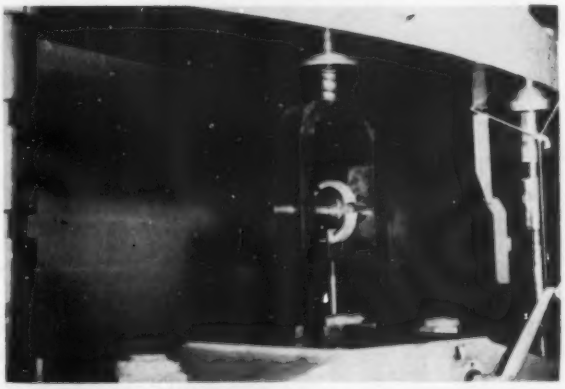


FIG. 6 Self aligning test fixture for tensile testing.

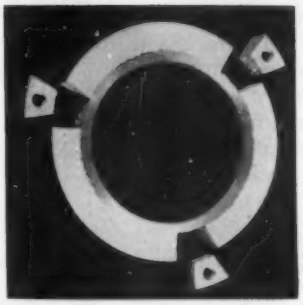


FIG. 7 Method of cutting isolated tensile test specimens of bimetallic bonded unit.

interference fit, castings. Testing showed failure at a load just enough to overcome friction. This load varied from 375 to 1670 psi and depended on the surface roughness of the insert. The high value was when the surface roughness was 90 to 100 micro-inches and the low value with a 25 to 30 micro-inch roughness.

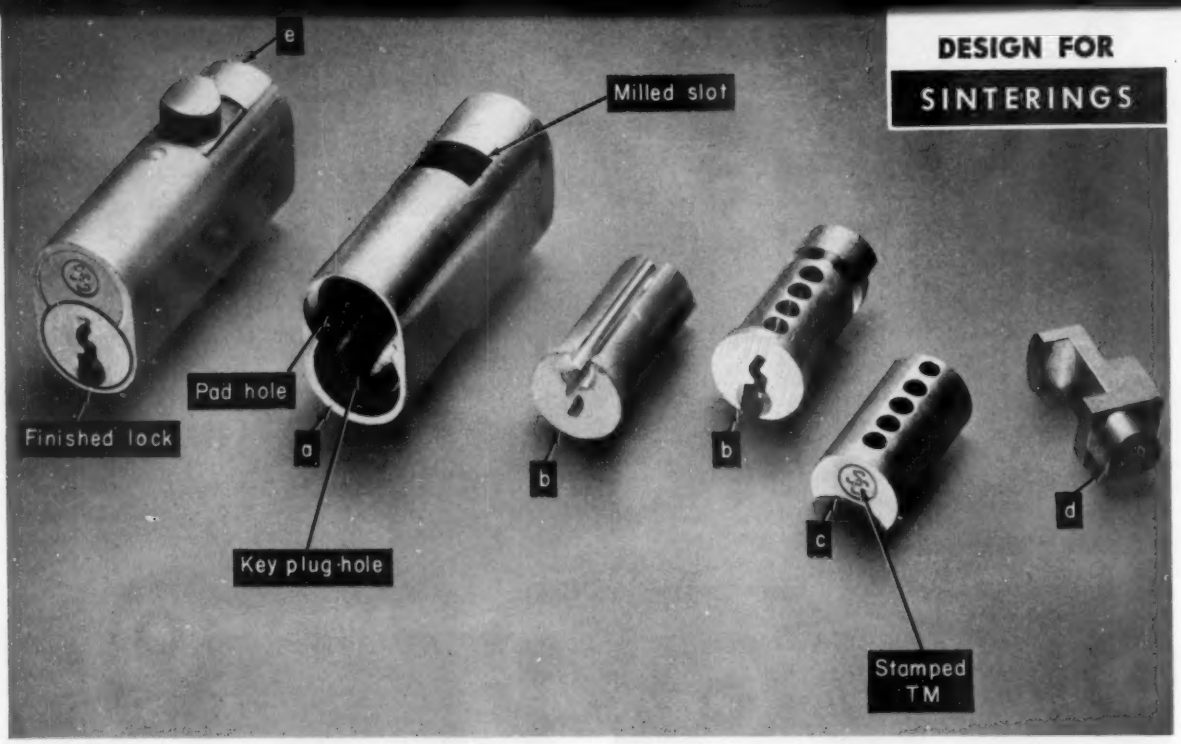
The shear strength of BMI bonds averaged about twice the strength of a purely mechanical bond. The values come close to the shear strength expected in the aluminum casting. Failure always occurred in the cast aluminum, never in the bond as shown in figure 5.

Tensile tests were made as shown in figure 6 and 7. Average results are given in Table II.

Tensile tests were made as shown in figures 6 and bonds were lower than published values. The slight curve on the test section stressed may have caused high local stresses with peeling at the brittle iron-aluminum interface.

The average values of tensile strength for BMI bonded test specimens varied depending on the method of cleaning. For all methods of cleaning, the average was 6500 psi. Why the cleaning method made the tensiles differ is not known. There was another variable, the number of undercuts per unit area. Where the tensile values were high, there were more undercuts per unit area than when the number was low. Generally a tensile strength of 6500 psi is probably a safe design figure.

The heat transfer properties at elevated temperatures are known to be better for BMI bonded specimens than for either metallurgical or mechanical bonds. However, test work on heat transfer is not yet complete so that data cannot be given.



INSURANCE COMPANY APPROVED LOCKS

made with sinterings and extrusions

A FIRE-RESISTANT file cabinet needs a fire-resistant lock, say the insurance companies. For this reason Sargent & Greenleaf, Inc. makes its locks out of alloys with a high melting point.

Regular file cabinet locks, made of zinc die castings, won't qualify as fire-resistant. So, engineers have designed this fire-resistant lock around extruded and sintered bronze parts.

THE LOCK HOUSING

The lock housing, (fig. 1a), is a solid extrusion in free machining brass. It's cut to length, then the holes for the pod. (fig. 1c), and the key plug, (fig. 1b), are drilled. At the end of the housing a slot is milled.

THE POD

The pod, (fig. 1c) is also a solid extrusion in SAE 72 brass. After cutting to length, five holes are drilled for the key pins and springs. The company's trademark is stamped and a radius is milled, (fig. 1c), to match the flange on the key plug.

The fire-resistant pod is a complete redesign from its die cast counter-part. The die cast pod is shaped like a blunt arrow head, a shape that is easy to die cast. This shape, however, would be difficult to machine in an extruded lock housing. To overcome this, the blunt arrow shape was changed to a radius. This only requires drilling two holes in the housing for the key plug and the pod.

THE KEY PLUG

The key plug, (fig. 1 b), is sintered in 80-20 bronze by the Reese Metal Products Corp. The key slot is used as sintered. This requires holding some close tolerances (+0.002 —0.000). But, as Mr. Robert B. Bouman, general manager of Reese says: "The tolerances specified seem quite normal to us . . .", This high degree of accuracy, possible by powder metallurgical methods, is an aid to the lock manufacturer. Normally, fabricators prefer to hold dimensional tolerances from ±0.005 in./in. to ±0.003 in./in. But, where they need closer tolerances, coining is necessary. Through the use of this procedure dimensions of ±0.001 in./in. and less can be held.

The end of the key plug is hollow milled. This could have been pressed into the part, but milling improves the rotating function of the plug. The only other machining required is to drill four holes.

THE BOLT

The bolt, (Fig. 1d), is also sintered in 80-20 brass by Reese. All that's required to complete the part is to drill 1 hole and hollow mill the radius at the top of the bolt.

THE BACK PIECE

The back piece, (fig. 1e), which holds the bolt in place, is the third brass sintering furnished by Reese. A back hole is drilled and tapped and a ¼" deep hole is drilled to house the spring, which keeps the bolt in the lock position.

All of the parts, except the bolt, are given a satin chrome finish. The housing is belt sanded for a satin appearance.

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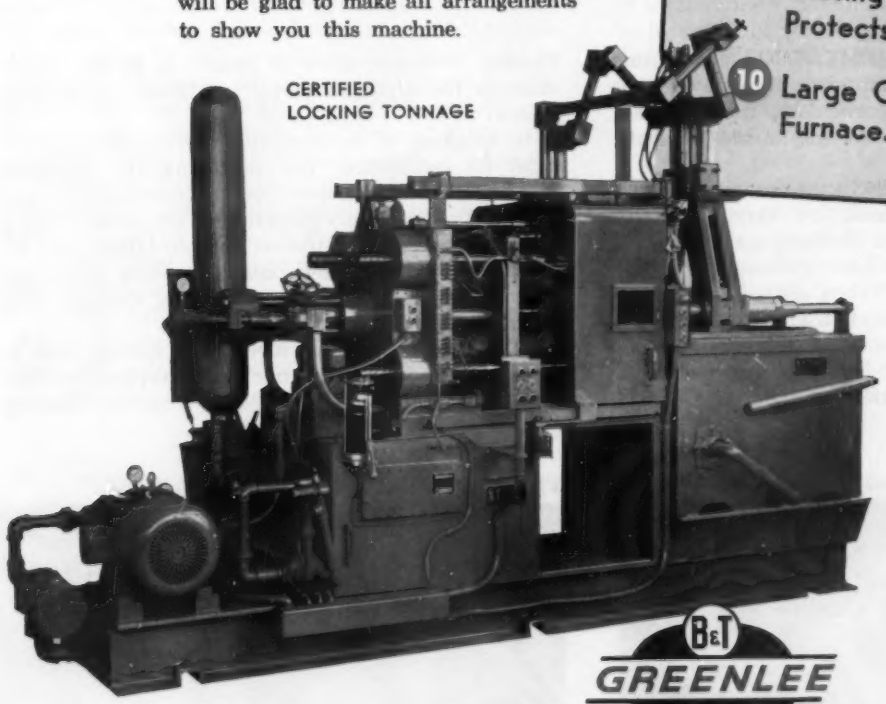

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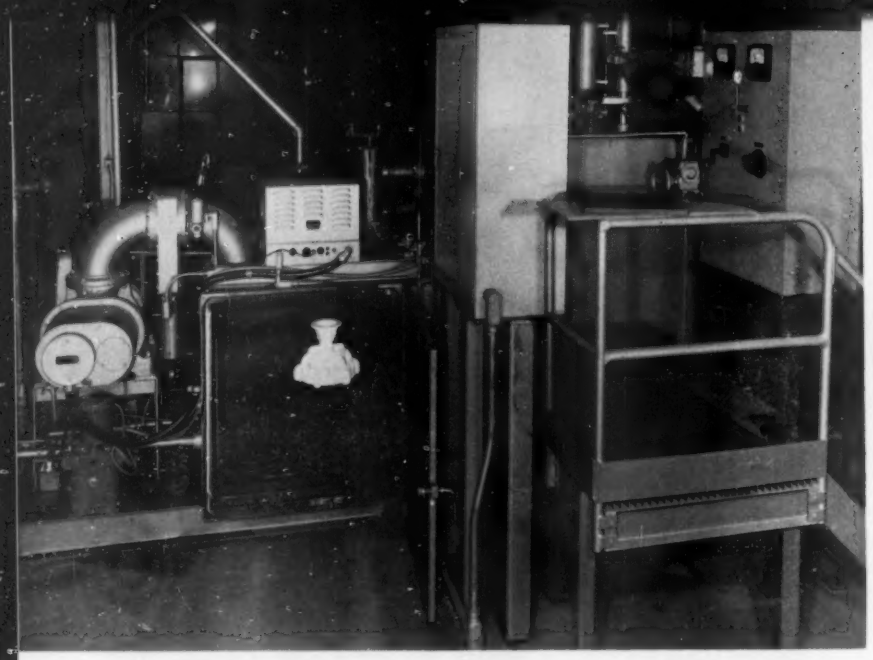


New Design Concepts

FIG. 1 VACUUM REMELTING and casting equipment. This unit has an induction heated melting furnace capable of holding 100 lbs. of steel. Charging, melting, and casting can all be done at reduced pressures. In addition to static molds, centrifugal casting equipment can be installed and operated in the vacuum chamber.

For the best properties in super-alloys specify . . .

VACUUM REMELTING & CASTING

VACUUM MELTING, REMELTING, and casting are becoming increasingly important in the investment casting industry. This is particularly true in those foundries who are doing work for missiles, aircraft, and gas turbines.

Many of the newer metals in the iron, nickel, and cobalt base alloys carry small, but very important, amounts of aluminum, boron, titanium, and zirconium. All of these alloying agents have a strong affinity for both oxygen and nitrogen. When melted in air both of these gases dissolve in the melt. They combine with the alloy to destroy the important alloying qualities and dirty the metal with oxide and nitride inclusions.

Even when melting is carried out under a protective blanket of argon there is enough diffusion of air through the argon to partly invalidate the alloying effect.

In speaking of vacuum, some frame of reference must be established. For this work the pressures involved are in the very low or fractional micron range. For consistently good results, the initial melting to make the alloy and the casting into billets must be done at these very low pressures. Then when the alloy is remelted and cast into shape, vacuum must again be used.

A typical remelt and investment casting unit is shown in figure 1. This is one of two vacuum melting and casting units built for Misco Precision Casting

FIG. 3 HOLLOW VANES cast in alloy WI-52

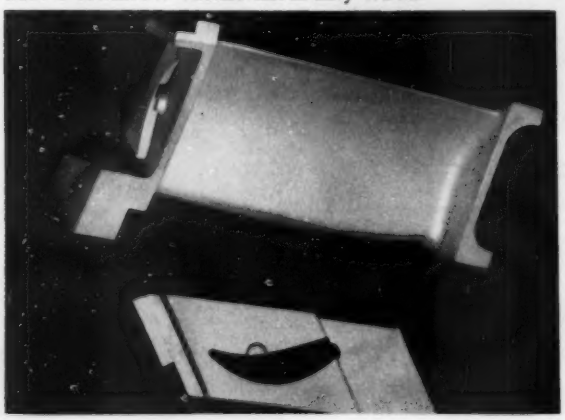
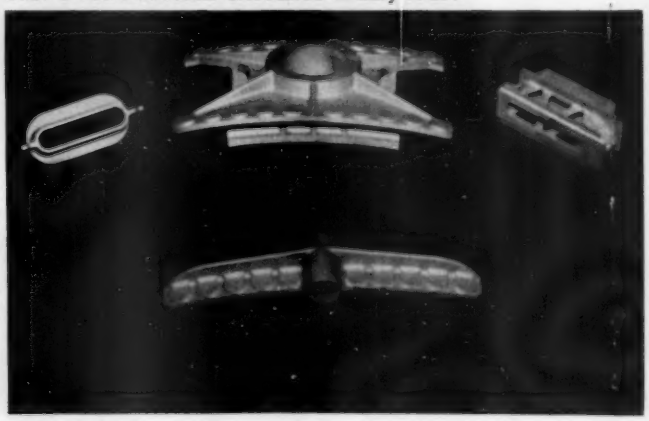


FIG. 4 STRUCTURAL CASTINGS in alloy A 286



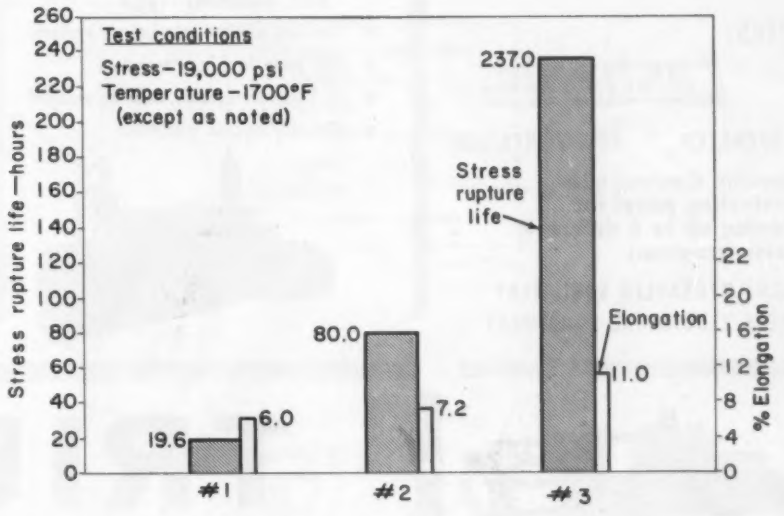


FIG. 2 IMPROVED PROPERTIES are secured by vacuum remelting and casting in monoshell molds. Data apply to alloy WI-52. No. 1 Standard investment mold; air melted, remelted, and cast. No. 2 Monoshell mold; air melted, remelted, and cast. No. 3 Monoshell mold; vacuum melted stock, vacuum remelted and cast. Test conditions: 1700°F/19,000 psi stress except 4 tests on No. 1 sample at 1600°F/25,000 psi and 11 tests at 1700°F/19,000 psi.

Co. by the F. J. Stokes Corp. Induction furnace melting is used, and in the unit shown the furnace has a capacity of 100 pounds of steel.

The effect of melting, remelting, and casting under reduced pressure compared with the same operations in air is shown in figure 2. Vacuum handling has increased the stress-rupture life by a factor of 12 and the elongation by a factor of 2.

In figure 2 there is a third remelt and casting condition noted where the alloy was melted, remelted and cast in air, but the mold is a so-called Monoshell. This mold is Misco's monolithic shell mold used in place of the conventional massive investment.

Many of these newer alloys get their good properties through carefully controlled rates of cooling. By the usual methods of investment casting, a relatively massive mold is required and the mold is always preheated before pouring the metal. Under these conditions, the rate of cooling is slow enough to give the high strength-high temperature alloys very undesirable properties.

Another failure of the conventional molds is lack of refractoriness in the mold. The alloying agents present in the metal often react with the mold material to give a rough, unuseable surface.

The solution of these problems has been found in the monolithic shells now being used by the industry. Monoshell is one of these molds (for a description of other types see PMM Nov., 1959, Dec. 1959, and Jan. 1960.)

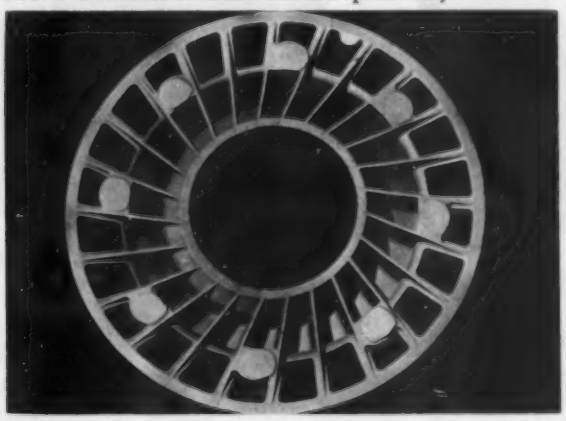
These shell molds are built up by alternate dipping and drying to about ¼" thick. After final drying they are fired at a high temperature to completely remove the wax or plastic pattern and to confer a high degree of refractoriness. The molds may be poured immediately or may be cooled and used later. Pouring may be done with the mold at any temperature from ambient up. As an aid to the controlled cooling of the metal, the shell may be backed up with any desired material or left unbacked.

Typical parts made in high temperature-high strength alloys are shown in figures 3, 4, 5, and 6. All of these parts were cast in Monoshells and all of the alloys were melted, remelted, and cast at very low pressures. Without the use of vacuum, the desirable properties of the alloys are not secured.

The design engineer may utilize these newer and better alloys where they are indicated. Foundries equipped with vacuum melting can make castings which develop the full potentialities of the alloy.

FIG. 5 TURBINE NOZZLE cast in Inconel 713

FIG. 6 TURBINE NOZZLE cast in a special alloy



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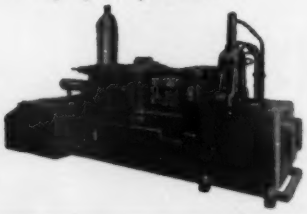

Model CASTMATIC 150
cold chamber type

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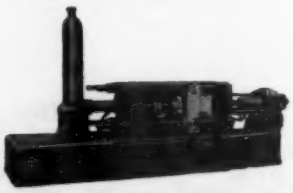
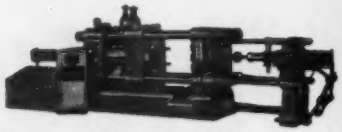
- 150 tons locking pressure
- 5.5 lbs. Copper, max. casting weight
- 1100 dry cycles per hour





Model CASTMATIC 600
cold chamber type

- Wedge clamping system
- Central screw for adjusting platen daylight
- 600 tons locking pressure
- 33 lbs. Copper, max. casting weight
- 240 dry cycles per hour

TRIULZI

Novate (Milano)
Italy
Via Vialba, 56

Telephone 3 49 16 61/2/3/4
3 49 17 86/6/7/8

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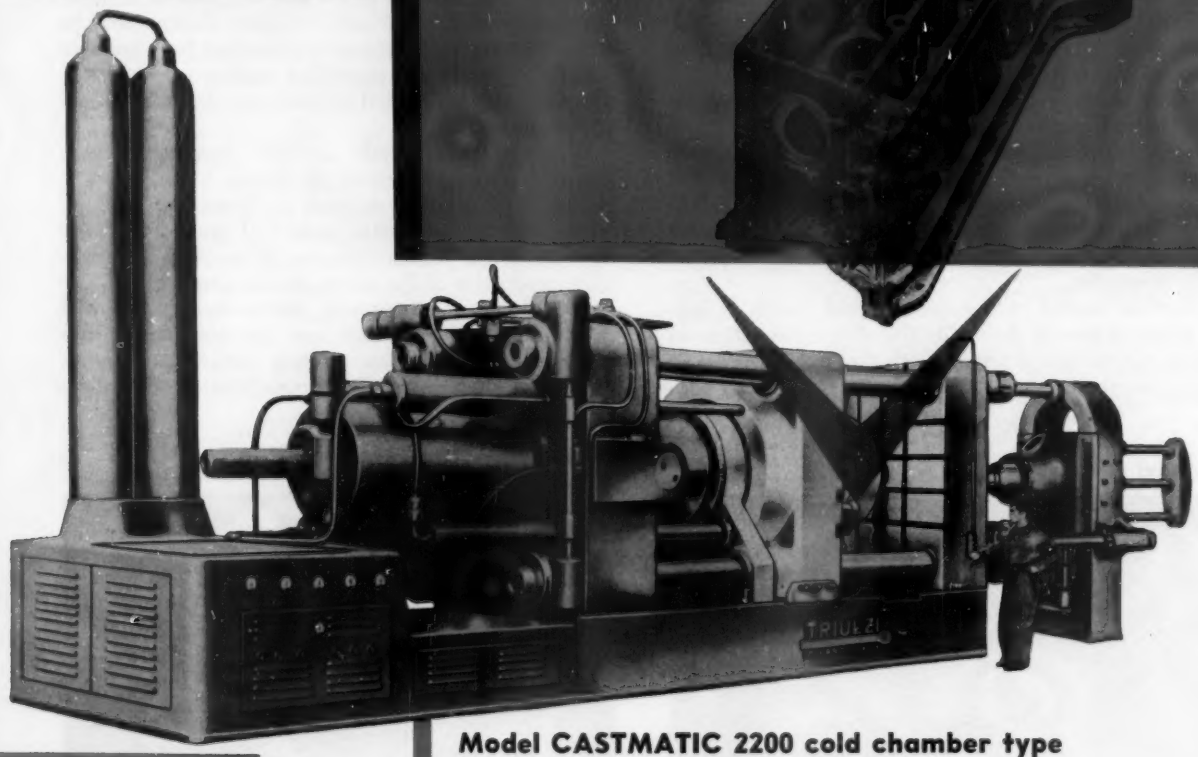

Model CASTMATIC 2200 cold chamber type

- Locked piston positive clamping system
- 2500 tons locking pressure
- 110 lbs. Aluminum, max. casting weight
- 98½" max. open platen daylight
- 59" moving platen stroke
- 73" x 77" . platen dimensions

ALL TRIULZI MACHINES can be equipped with:

- Equipment for obtaining vacuum in the die
- Automatic ladling and filling devices

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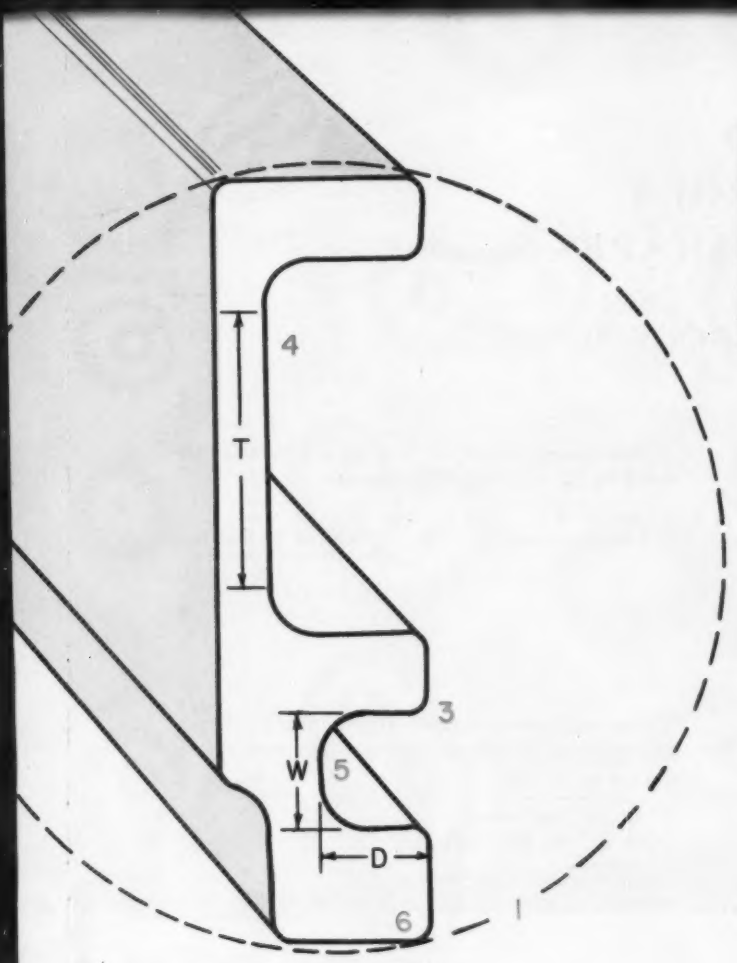


STEEL AND SPECIALTY ALLOY EXTRUSIONS

PART I — *Design and Tolerance Guide*

Small orders for steel and stainless steel shapes in continuous lengths up through 60′ can be most economical when made by the extrusion process.

This includes orders of 300 pounds through 20 tons and more, and probably averaging about 3,000 to 8,000 pounds. (Cut lengths range from ¼″ through 60′.) These orders are too small for rolling mill loads and too large to be economical by other methods such as forging and screw machines.

Tooling charges help keep the costs down. Dies cost as little as $200 for solid shapes.

To help decide whether extruded ferrous parts are most economical, an extruded parts supplier should be consulted. The design and tolerance data listed here is to be used as a guide.

Information for this article and two to come in following issues has been made available by The H. M. Harper Company of Morton Grove, Illinois.

DESIGN GUIDE

1 CIRCUMSCRIBED CIRCLE —This diameter is the smallest circle to completely enclose the cross-section of the shape.

2 MINIMUM SIZE —This is determined by the cross-sectional area and the resistance of the given steel, at a given temperature, to deformation and other factors. The minimum cross-section is not less than 0.50 square inches.

3 CORNERS—Normal production radii are .062 inches.

4 MINIMUM THICKNESS —The minimum production thickness is 0.180 inches. Maximum ratio of cross-section length to cross-section thickness is 14 to 1 for each segment of section. Rapid advances are being made which will allow ⅛ inch minimum thickness.

5 FILLETS —Normal production radii are 0.250 inches.

6 INDENTS —Depth of indent (D) should be no greater than the width (W) of the indent.

EXTRUDED FERROUS SHAPES *(Continued)*

TOLERANCE GUIDE

CONDITION

Extruded solid shapes are available in the following conditions and finishes:

Condition

1. Extruded and straightened
2. Heat Treated

Finish

1. Hot Finished
2. Deglassed
3. Pickled, Blast Cleaned or otherwise Descaled

TOLERANCES ON CROSS-SECTIONAL DIMENSIONS

Specified Dimensions	*Tolerances*
Under 1″, inclusive	plus or minus .020″
Over 1″ to 3″, inclusive	plus or minus .031″
Over 3″ to 4½″, inclusive	plus or minus .046″

CORNERS

In general corners have a radius tolerance of .062″.

FILLETS

Fillets normally have .062″ radius tolerance.

ANGLES

Angles of extruded solid shapes have a tolerance of plus or minus 2 degrees from the designated angle, unless otherwise specified.

DRAFTS

Unless otherwise specified, the internal vertical sides of "U"-shaped sections have a draft of not exceeding 5 degrees.

TRANSVERSE FLATNESS

Allowable deviation from flat is .010″ per inch of width, .010″ minimum on dimensions less than one inch.

CAMBER

Unless otherwise specified, extruded bars are straightened to the following tolerances:

$$\text{¼″ in any 5′, but not to exceed } \tfrac{1}{4} \times \frac{\text{Number of feet in length}}{5}$$

TWIST

Unless otherwise specified, extruded shapes are straightened to the following tolerances:

Width of Section	*Rise in 5 Feet*
½″ to 1½″, inclusive	0.125″
Over 1½″ to 4½″, inclusive	0.188″

$$\text{The above not to exceed amount of rise} \times \frac{\text{Number of feet in length}}{5}$$

LENGTHS

Random Lengths

When random lengths are specified for any solid extruded shapes, the permissible length variation shall be up to 24″.

Multiple Lengths

When multiple lengths are specified, ¼″ is added to the length of each bar for each multiple contained, unless otherwise specified. Tolerances for length shall be as shown in the table below:

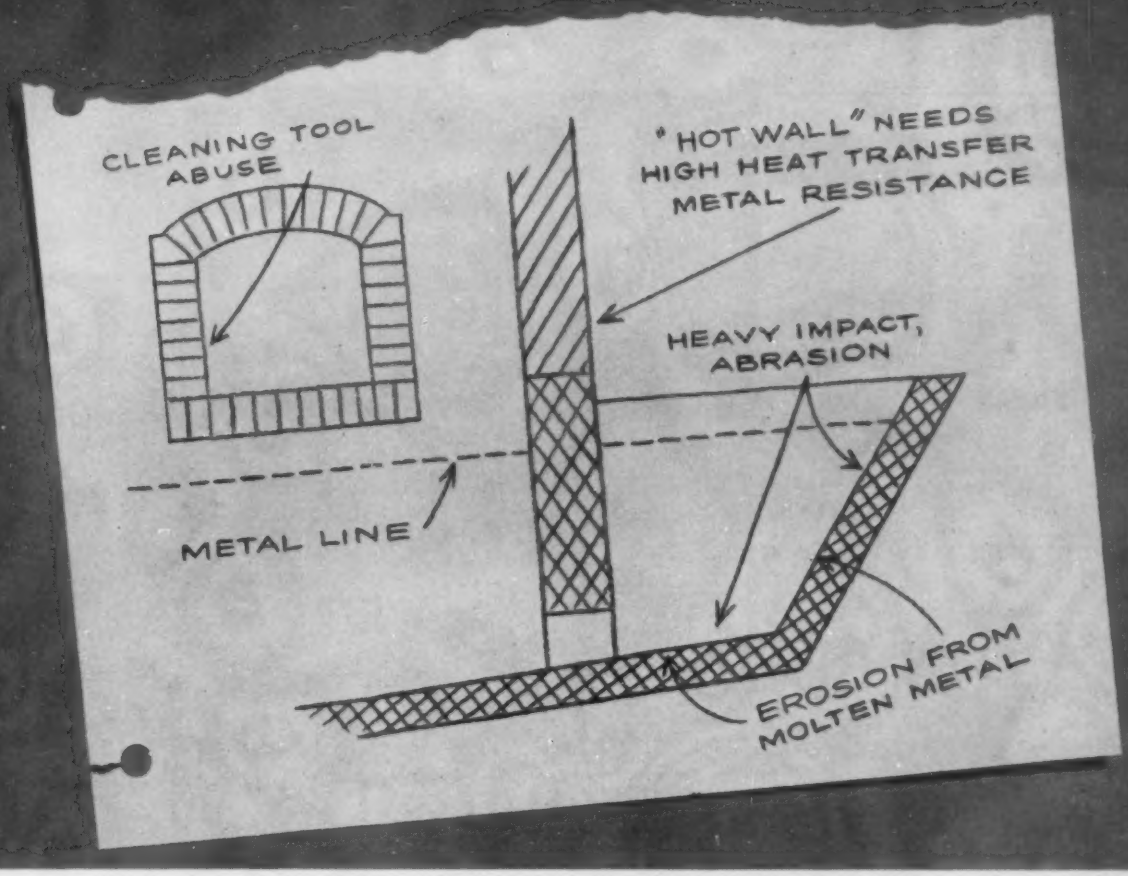
Exact or Dead Lengths

When exact or dead lengths are specified, tolerances for length shall be shown as in the following table:

	Variations	
Length	Over	Under
Under 12′, inclusive	3/16″	0
Over 12′	1/4″	0

SURFACE FINISH

Extruded shapes will be furnished with a maximum roughness of 250 RMS. This value is to be used as a guide only as the alloy and the shape determine to a large extent the best degree of microfinish.


CLEANING TOOL ABUSE
"HOT WALL" NEEDS HIGH HEAT TRANSFER METAL RESISTANCE
HEAVY IMPACT, ABRASION
METAL LINE
EROSION FROM MOLTEN METAL

Design hints on refractories for aluminum furnaces

How to help charging ramps take the gaff of impact and abrasion

Nine-inch soldier courses and 4½" rowlock courses of CARBOFRAX® 10-D silicon carbide brick, with thin trowelled joints, provide the most effective answer to abuse encountered at the charging ramps of reverberatory-type aluminum melting furnaces. This is the experience of leading furnace users throughout the country.

CARBOFRAX brick have the exceptional wear-resisting properties necessary to stand up under the impact and abrasion of charging ingots and scrap. In addition, they have high resistance to penetration, erosion and attack by molten aluminum, contributing to long service life and reduction of metal losses due to absorption by refractories.

Special-purpose refractories made by Carborundum offer a choice of materials to meet widely varying needs in all critical areas of aluminum melting furnaces.

CARBOFRAX *ceramic-bonded silicon carbide*, for example, is made in a variety of compositions suitable for hot walls, side walls, bottoms, charging ramps and door jambs and sills. REFRAX® *silicon-nitride-bonded silicon carbide* can be supplied in accurately dimensioned shapes with high strength and resistance to thermal shock. It is not wet by molten aluminum. Applications include launders, troughs, spouts, tap-out blocks and stoppers and pyrometer tubes. Special uses are found in furnaces subject to intermittent operation. ALFRAX® *fused alumina bubble insulating brick* are light in weight, withstand high temperatures and have the low heat transfer qualities needed in walls and roofs above the metal line. MULLFRAX® *electric furnace mullite* offers resistance to flame erosion and spalling plus low heat conductivity. It is widely used for burner blocks.

For assistance and recommendations on how to engineer refractories to your specific furnace needs, contact Dept. R-50, Refractories Div., Carborundum Co., Perth Amboy, N. J. Phone: Hillcrest 2-3380.

For engineered refractories . . . count on

CARBORUNDUM®

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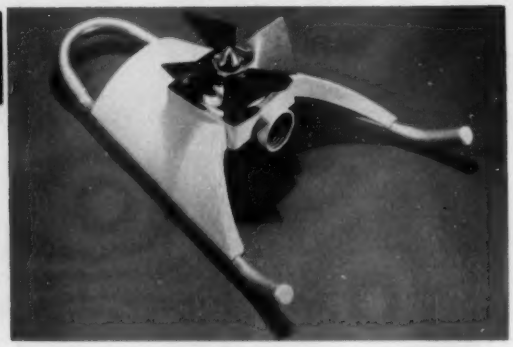
DESIGN FOR
DIE CASTINGS



Designing for die casting . . . **KEEPS**

THE BUSINESS IN AMERICA

WHEN PRICE COMPETITION GETS TOUGH in the field of inexpensive consumer goods, lots of American manufacturers turn to Japan or Europe for cheaper parts.

But here's a case where American die-casting know-how has brought the price of a part down so low that even poorly-paid Japanese labor can't compete.

A DIE CASTING and an extrusion make up the principle parts of this sprinkler. Lightweight and strong, only these processes will give the desired design.

And not only does the American product meet the Japanese alternative – an iron sand casting – on price, it beats it on quality.

Melnor Industries, a leading maker of garden accessories, decided last year to bring out a new rotating lawn sprinkler to sell for less than two dollars. The problem was thrown into the lap of John D. Beinert, industrial designer, who has designed Melnor's sprinklers since 1954.

Like any good designer, Beinert isn't married to any one material or process; he picks the ones that are best for the job at hand.

For most of his sprinkler design problems through the years, zinc die castings have provided the best solution. In this case, because of the low target price, Beinert tried for an even more economical approach.

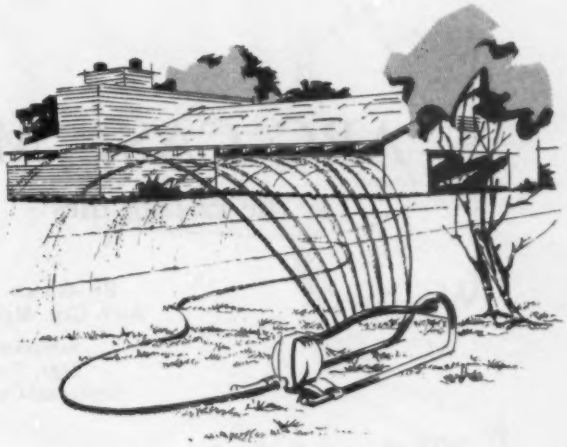
It looked for a while as if the best bet would be to use a cast-iron base, made in Japan. But when all the chips were counted, die casting won again. When shipping cost and all the machining and finishing steps that could be eliminated were added up, the zinc die castings were competitive with the Japanese product. What's more, Beinert says, he got an appearance and finish that he couldn't have matched with cast iron.

The final design is a simple two-arm sprinkler, mounted on a non-tip zinc die-cast base finished in bright gold enamel. It retails at $1.95. The zinc part weighs 0.4 lb. The iron part would weigh 1.0 lb. This pays off in lower shipping costs. Partly, the lower weight results from the ability to die cast zinc in thin

sections, with stiffeners as needed. The average web thickness in the die casting is 0.045 in.

There are a number of reasons that usually make zinc die castings preferable to aluminum die castings, cast iron, or plastics in lawn sprinklers, Beinert points out.

- A lawn sprinkler should be strong; it gets kicked and dragged around behind the hose. This favors metal over plastic.
- It should feel substantial; the customer associates heft with quality and long life. Again this favors metal over plastic.
- It should be dimensionally stable; mating parts mustn't warp while waiting for assembly, and moving parts mustn't bind as a result of warpage after use. Again, metal over plastic.
- It must look good; it's got to compete against other lines in the dealer's display. The smooth as-cast surface of a die casting takes enamel without the need for preliminary grinding, tumbling or buffing. It would be nearly impossible to match this finish on cast iron, even with considerable work. With plastics, choice of colors would be limited, and there'd be the possibility of color changing or fading.
- The price has to be reasonable. This is a very competitive business. Zinc die castings are generally cheaper than similar aluminum die castings. They hold a price advantage over cast iron because they can be produced in complicated shapes, practically ready for assembly, with studs, index holes, and screw holes incorporated right in the die design. All

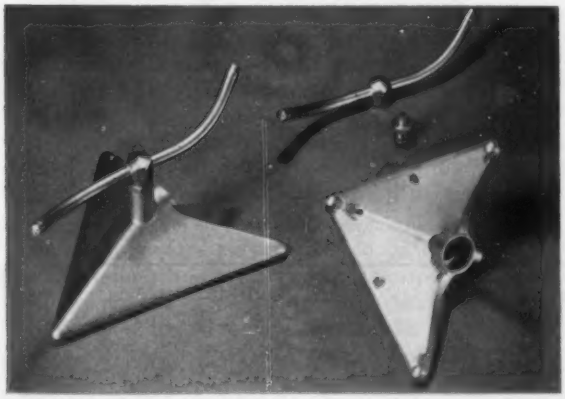


that has to be done usually is to remove the flash and sprue in a trimming die, and sometimes to face mating surfaces.

Probably the best known of the Melnor sprinklers are the oscillating types, designed to water a rectangular area. These consist of a water motor enclosed in a two-piece housing; a dial control to adjust the spray area; a perforated aluminum spray tube, which is oscillated by the motor; skids made of aluminum tubing; and a mounting plate on which the assembly goes.

The two parts of the housing are zinc die castings, with all channels studs, and holes cast in. Before assembly, the two castings go into a trimming fixture which removes flash and sprue. Then the mating side of the front part is faced to take a waterproof gasket, and the assembly holes are broached. The housing

continued on page 99



TO COMPETE with imports, zinc die castings are used. They give strength, long life, and attractive appearance.

THE EXTRUDED tabular base prevents gouging the lawn and the die cast body cuts manufacturing costs.

BECAUSE ALL HOLES for both screws and bearings can be cored, this die cast housing permits fast, low-cost assembly. Wherever possible, low cost die cast parts are used. This sprinkler uses six different castings.

ARC CAST MOLYBDENUM

. . . for die casting dies

By HAROLD M. MCCULLOCH
Ass't. Gen. Mgr., Refractomet Div.

NORMAN W. CAULKINS
Mgr. Tool Steel Sales
Universal-Cyclops Steel Corp.

THE DIE CASTING industry is continuously confronted with the problem of obtaining materials satisfactory for die casting tooling. The three main causes of short die life are heat checking, soldering and mold wash, and the severity of these increases as the casting temperatures increase.

Within the past few years studies have shown that molybdenum and the Mo-0.5%Ti alloy can be used to great advantage in the aluminum and zinc die casting industry. Some properties of Mo-0.5%Ti alloy are compared with H13 Tool Steel (Universal-Cyclops' Thermold AV) in Table I. This data shows that molybdenum has a superior resistance to heat checking, a very high thermal conductivity, and a low coefficient of thermal expansion when compared with the common die steels. Water cooling of dies may not be required because of the high thermal conductivity; and the holding of closer tolerances are permitted because of the low coefficient of thermal expansion. The modulus of elasticity of molybdenum is twice that of steel and, as a result, is an important consideration for the rigidity of core pins. The Mo-0.5%Ti alloy is readily machined. Furthermore, it requires no heat treatment, whereas the die steels must be heat treated to obtain optimum properties. It should be pointed out, however, that its lack of hardenability by heat treatment does impose some limitations in its use. Care must be exercised in its handling, and a recognition of the fact that it is a new type of material—not just a new grade of steel—will help avoid unsatisfactory experiences.

Numerous examples of successful trials have been quoted utilizing molybdenum alloy cores in zinc and aluminum die castings. On most of these trials comparisons were made with standard Tool Steel cores. In nearly all cases the molybdenum alloy was superior to a steel such as H13 Tool Steel. In figure 1, two typical examples are illustrated. Figure 1(a) shows a Mo-0.5%Ti alloy core bolted to a satitionary die. The molybdenum alloy core lasted for nearly 30,000 shots compared to less than 6,000 shots for H13 die steel when casting aluminum. Virtually no soldering was encountered using molybdenum and the cores required light polishing after every 7,500 shots. Figure 1(b), similar to (a), shows a core which was still in excellent condition after 30,000

TABLE I

	H13 Tool Steel (Thermold AV)	*Mo-0.5%Ti Alloy*
Resistance to Heat Checking—On Zinc	Good	Very Good
—On Aluminum	Fair	Very Good
Thermal Conductivity, BTW/ft²/ft/°F./Hr.	16-17	68
Thermal Expansion 10^{-6}in./in./°F./(32-1200°F.)	7.1	3.3
Ultimate Tensile Strength, psi (Room Temperature)	225-250,000	110,000
Hardness—Rockwell Scales* (Room Temperature)	C47-C51	C28
Ultimate Tensile Strength, psi (1000°F)	160,000	90,000
Hardness—Rockwell Scales (1000°F.)	C41	B76
Elastic Modulus, 10^6 psi	24	48

*Note—Rockwell Hardness values for Mo-0.5%Ti are approximate and are converted from Diamond Penetration Hardness method actually used and recommended for this material.

shots compared to less than 20,000 shots for a die steel. The die steel core required maintenance after every 5,000 shots causing a minimum of six hours production down time and maintenance labor. The molybdenum alloy core did not require any maintenance or cause any down time whatsoever. Although molybdenum is higher in cost than die steels, its utilization for these cases is certainly justified when the losses due to production down time, maintenance costs and frequency of replacement are considered.

Molybdenum by no means is a cure-all to the problems encountered in the die casting of aluminum and zinc. Instances have been reported on unfavorable soldering and cracking of cores for which, at the moment, there is no explanation. Also, molybdenum has not been too successful in the die casting of brass. Soldering and core washing have been the major problems.

If one considers the following suggestions in the preparation and use of molybdenum cores for die castings a significant economic advantage should be realized.

1. Study the desired application carefully, keep the physical and mechanical properties of molybdenum in mind.
2. Avoid any bending stress or squeezing action.
3. Have an educational program for die men and casting personnel.
4. If a slide or moving core is used be sure the core pulling mechanism is rigid.
5. Make sure the die has a substantial ejector mechanism. Don't cock the casting during ejection.
6. DO NOT MAKE ANY SHOTS until the die has been evenly preheated (300° to 400°F. for aluminum, 600° to 700° for brass) and the temperature positively determined. Flame impinging directly on cores and cavity parts is a poor and harmful method of preheating a die.
7. The die temperature should be maintained as uniform as possible.
8. If a molybdenum core is located in a heavy boss or casting section and becomes hot enough to allow soldering, a copper pad directly in contact with the molybdenum core, below the impression will often dissipate enough heat to prevent soldering. *Limited water cooling* has been used. Keep water lines in cores well back from impression area; also consider possibility of combining steel and molybdenum in a core and cool steel part only.
9. After machining molybdenum cores they must always be draw polished; this will eliminate microscopic machining grooves. Grinding or lathe polishing is usually not satisfactory.
10. When fitting cores of larger diameters (over 1½" diameter approximately) in blind pockets (stationary cores), a light shrink fit is suggested to insure clean shut off. This is necessary due to the thermal expansion of molybdenum relative to steel. Use self-cleaning cores whenever possible.
11. Avoid sharp inside corners whenever possible. If this becomes necessary, consider the possibility of making the core in two pieces to avoid a stress raiser using a steel sleeve construction. Also, if the guide hold for a moving molybdenum core becomes distorted in any way, consider steel sleeve construction below the impression to protect the molybdenum from undue wear.
12. Allow some clearance where core would normally bump, as in a thru-hole.
13. When fitting small molybdenum cores a clean sliding fit is desired, so if removal of core becomes necessary, it will not be destroyed while removing it.
14. Be cautious in selection of applications requiring cores larger than 2½" diameter. Larger cores seem more susceptible to gross cracking.
15. Machining of molybdenum should be performed with sharp tools. Carbide tools are recommended.
16. Where it is necessary for ejector pins to pass through molybdenum it may be possible and advisable to insert a steel sleeve guide in the back of the molybdenum to protect it from wear.

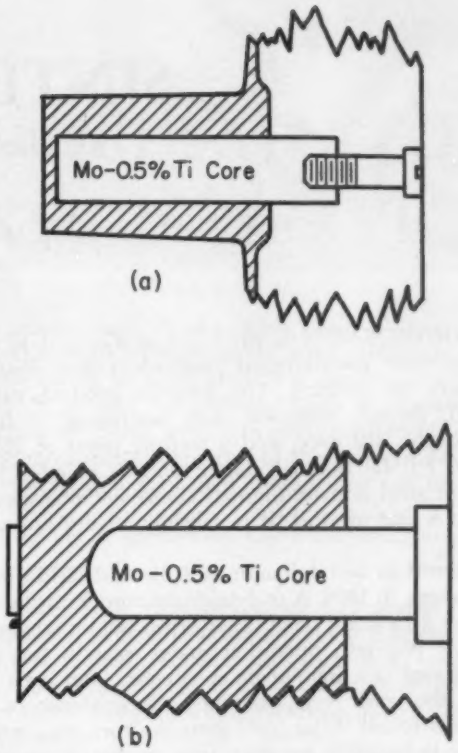


FIG. 1 TYPICAL MOLYBDENUM core applications. (a) Core dimensions 7/16" dia. x 2" long. Held in block by cap screw threaded into core. (b) Core dimensions 5/8" dia. x 2-1/2" long. Core machined with shoulder to lock into die block. Precise alignment and close fits are required in both cases to prevent damage during ejection.

A portion of the material covered in this report was contributed by the American Die Casting Institute. Molybdenum is only one of the materials currently under study at Battelle Memorial Institute where a joint research program to develop better die materials is under way.

Editor's note: This is the second progress report on molybdenum die materials to be published in PRECISION METAL MOLDING.

More about Molybdenum dies on page 56

New Design Concepts

SINTERED MOLYBDENUM

. . . for die casting dies

By H. P. Kuebrich,
Lamp Metals & Components Div.,
General Electric Co.

MOLYBDENUM is produced at General Electric by powder metallurgical methods rather than by vacuum arc melting. The sintered product can be rolled, forged, extruded, and machined. It has a density of 10.2 g/cc, and a melting point of 2612°C (4730°F). Its thermal conductivity is about 3 times that of steel and its thermal coefficient of expansion about ½ that of steel. It is a bright silvery appearing metal.

Interest in molybdenum as a die casting die material began in 1958. A molybdenum core for a die used to cast a medium sized brass brush holder was made. It was put into operation under exactly the same conditions as a companion steel core. After each 1000 shots the cores were examined. No evidence of failure was found. After 3500 shots the core was chipped either in handling between runs or during operation.

The apparent success with brass castings made the casting of aluminum seem attractive. In this case the complete dies for making aluminum components for a small motor were made. After about a year of operation the dies are still operating most satisfactorily. But since the life of steel dies in this operation is from 75,000 to 100,000 and the molybdenum dies have not sufficiently passed this number of castings, a full evaluation can not be made. The dies are still in service.

Based on limited testing some tentative conclusions can be drawn.

1. Molybdenum shows no evidence of heat cracks or heat checks.
2. Molybdenum will wear at least as well as steel in production die casting of aluminum.
3. Molybdenum seems to require less polishing and dressing than steel. The result is less machine down time, this helps to offset the higher material costs.

While the limited work done to date indicates some advantages exist in using molybdenum, it is only fair to bring out some of the minus factors which should be considered before making any decision to use molybdenum:

1. If cores or small die sections can be made from standard production bar stock; that is, rod 1¼" diameter and down, or from plate or slab in the order of ¾" thickness 6" wide or less, cost of molybdenum over die steel would be approximately twice the cost of die steel. If larger sections, forged or rolled to order, were required, the cost might be up to 4 times die steel depending on the quantity and the shapes required.
2. While molybdenum is fairly easily machined when the correct lubricants and tools are used, it is not as easily machined as steel, especially if the die contains any long thin sections. It can be machined at room temperatures using ordinary tooling and rather complex operations can be done. Since molybdenum has very low impact strength at room temperature and is notch sensitive, breakage or chipping is a problem that must be recognized and guarded against. Rigid tooling must be used and, although high speed steel tools are satisfactory, greater tool life is obtained using carbide tooling. Speeds, feeds and rake angles should be similar to those used in machining cast iron. The primary factor, however, in machining molybdenum, is the lubricant. Care must be taken to select one that prevents adherance of the molybdenum to the tool tips. Since the ductility of molybdenum is greatly increased by high temperatures, the danger of breakage or chipping in operation is very slight.
3. Molybdenum is not particularly hard and the hardness cannot be increased by heat treatment. The hardness can only be raised by work hardening as in the case of large sections which must be used hot; such as those which would be used in manufacturing dies. The hardness will not be far in excess of Rockwell B90. There is danger therefore that parts will be deformed particularly when hot. The tensile strength is also low when sizes are such that the material is not work hardened a gread deal. And we have had long thin (⅛" diameter) cores rupture in tension rather than pull free from the surrounding metal.

These disadvantages, it is felt, can be overcome. However, it is necessary that they be recognized and considered in the evaluation of molybdenum for die casting applications.

Besides using molybdenum directly, as has been done at both our two G-E locations, there are some other interesting, possible applications for molybdenum in the die casting industry which are currently being reviewed.

One of these is the possible use of molybdenum for spray metallizing steel dies to build up and repair badly eroded or damaged areas. Another is the use of molybdenum in the die casting machines themselves where the corrosive effects of molten metal tend to attack steel fairly rapidly. Molybdenum liners for nozzles or in the pressure chambers or solid molybdenum pistons may prove to have some advantage.

New Design Concepts

NEW METALS FOR HIGH TEMPERATURE SERVICE

THE METALLURGISTS have almost kept pace with the demands of the design engineers. Almost, but not quite. Every time the design group sets up new targets, the metallurgists go to work and come up with a new super-alloy which meets specifications. Then the designer says . . . "yes, but this is what I really want." Then the race is on again.

But give the metallurgist due credit. He has come up with some weird combinations that do a surprising job. For example:

WI-52

In 1958 the minimum acceptance was a stress rupture life of 23 hours at 1800°F under a stress of 15,500 psi. Then WaiMet Alloys Co., The Tungsten Institute, and the Investment Casting Institute went to work. Today a modification of this alloy has a stress rupture life of almost 100 hours under the same test conditions. Rupture elongation was originally set at 5% minimum, today's alloy has rupture elongations as high as 26%.

These improvements came about mostly through small changes in alloy chemistry. In fact, modification 5 is identical to the original alloy in all respects except iron and columbium. Here the iron has been changed from 0.6% max. to 1.0 to 2.5% and combined columbium and tantalum changed from 1.5 to 2.0% to 1.5 to 2.5%. These minor changes have made the big difference.

This alloy is easily cast and the high performance inherent in the alloy is readily secured in investment castings.

RENE' 41

A nickel base alloy developed by General Electric Co. It has good high temperature-high strength properties, but starts to oxidize at an appreciable rate above 1650°F. The alloy contains important amounts of boron, aluminum and titanium. It must be melted, remelted and cast in a vacuum. Both castings and wrought shapes can be made.

Heat treatment of the alloy is to homogenize for 3 hours at 1950°F and quench in oil or water. As heat-treated the hardness is 30 R_c. Average tensile properties are:

Test Temp.	0.02% Yield, psi	0.20% Yield, psi	Ultimate Tensile	% elong-ation	% Red. in area
Room	90,000	103,000	120,000	8	10
800°F	85,000	92,000	105,000	8	10
1200	80,000	90,000	105,000	10	10

The alloy has good castability and is easily welded. It shows no tendency toward hot shortness. The castings are generally used for intricate shapes which are later welded onto sheet fabrications.

Specifications for castings call for a minimum stress rupture life of 25 hours at 1650°F under a 25,000 psi stress. At present not sufficient data is available to determine probable maximum stress rupture life.

The mechanical properties of the wrought René 41 are somewhat higher than those given for the cast product.

This alloy is melted by Cannon-Muskegon Corp.

NICROTUNG

A nickel base alloy containing aluminum, boron, titanium and zirconium as important alloying elements. It is best melted, remelted and cast under vacuum. The alloy was developed by Westinghouse Electric Corp. and is designed for applications in the 1500° to 2000°F range.

As cast Nicrotung has a hardness of 38 to 40 R_c, it is nonheat treatable. The alloy can be machined with carbide tools using low speeds and feeds. Finish machining is best done by grinding.

Average mechanical properties are:

Test Temp. °F	Ultimate Tensile psi	0.2% yield psi	% elong-ation/in.
70	130,000	120,000	5
1200	120,000	111,000	11
1500	115,000	102,000	4
1600	86,000	76,000	4
1800	67,000	52,000	6

Guaranteed minimum stress rupture properties of investment cast Nicrotung are:

Temp. °F	Stress, psi	Hour to rupture (min.)	% elong. (min.)
1700	35,000	30	3
1800	25,000	30	4
1900	15,000	30	5
2000	10,000	30	6

These are only three of the recently developed, or improved, alloys. The well known age hardenable, stainless alloy, 17-4PH has had some slight changes in its chemistry. The results, better corrosion and oxidation resistance and almost doubled elongation.

These new or improved alloys are not, of course, the only ones which have been developed recently. They are, however, indicative of the progress which has been made so that the design engineer may have a wider choice of materials for his investment cast parts.

Material for this report was contributed by:
Cannon-Muskegon Corp.
General Electric Co.
Westinghouse Electric Corp.
WaiMet Alloys Co.

FIG. 1 An aluminum extruded tube-plate showing the tube openings—smaller than the diameter of a cigarette.

DESIGNED FOR ATOMIC REACTORS

ELEMENTS REQUIRED for making the above tube-plate aluminum extrusion can be easily adapted to serve the industries that deal with heat transfer, accuracy and unusual shapes. The tube-plate is an early step in the manufacture of fuel and blanket elements for the natural water-cooled Borax-IV reactor at Arco, Idaho. Problem of manufacture was tackled by Argonne National Laboratory, who's staff researches peaceful use of the atom.

To build the final elements, several requirements had to be met on tube plates: accurate measurements; fast heat exchange; high resistance to corrosion; stiffness; avoid excessive costs for original plates; and keep operational costs low.

FIG. 2 Not only are the openings in the figure 1 tube-plate smaller than a cigarette's diameter, each passage has minute ribs raised on the insides. Eight openings in each plate had to meet exacting requirements and tolerances as prescribed by this drawing. Detail "A" is almost double size and shows what Precision Extrusion, Incorporated engineers worked out by the extrusion process to give Argonne the complicated aluminum shape required.

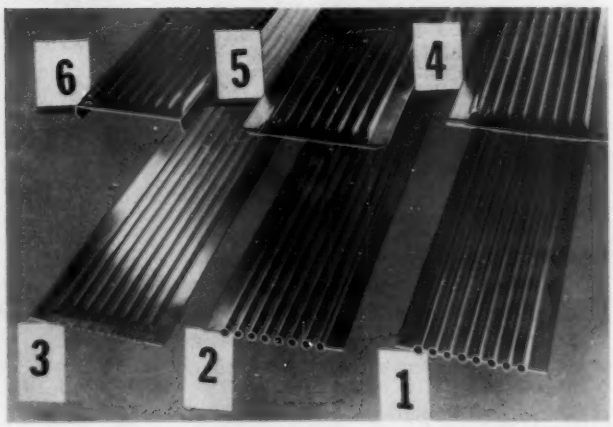


FIG. 3 Six steps were required to prepare the plates after extrusion.

1. The plate.
2. Connecting plate web trimmed ⅛ inch by gang milling.
3. Uniform flattening by cold pressing.
4. Ceramic bodies loaded, a hot press seals the opposite end.
5. Annular spaces are filled with lead. Unsealed portion of the flat section is trimmed and corners are cut off at 45° angles.
6. Edges are bent to form flanges so that six plates can be fit into a fuel subassembly.

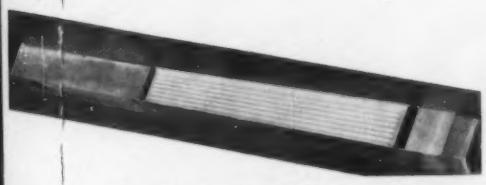


FIG. 4 Completed fuel assembly made up of subassemblies with machined cast-aluminum end fittings plug-welded to them.

Design of the plate is exacting. Eight tubes of accurate dimensions are placed parallel to each other to get a controlled chain reaction.

Before deciding what would be the best and most economical method to manufacture the plates, Argonne viewed several methods.

Brazing tubes to spacer plates was one method. It was rejected because of a lack of sufficient resistance to corrosion, difficulty in obtaining dimensional accuracy, and the excessive cost.

Roll-bonded aluminum strips, a special strip having heat-exchange passages which could be expanded, were also considered. They too were rejected. Strips were hard to get, the cost was prohibitive, and they wouldn't have been stiff enough.

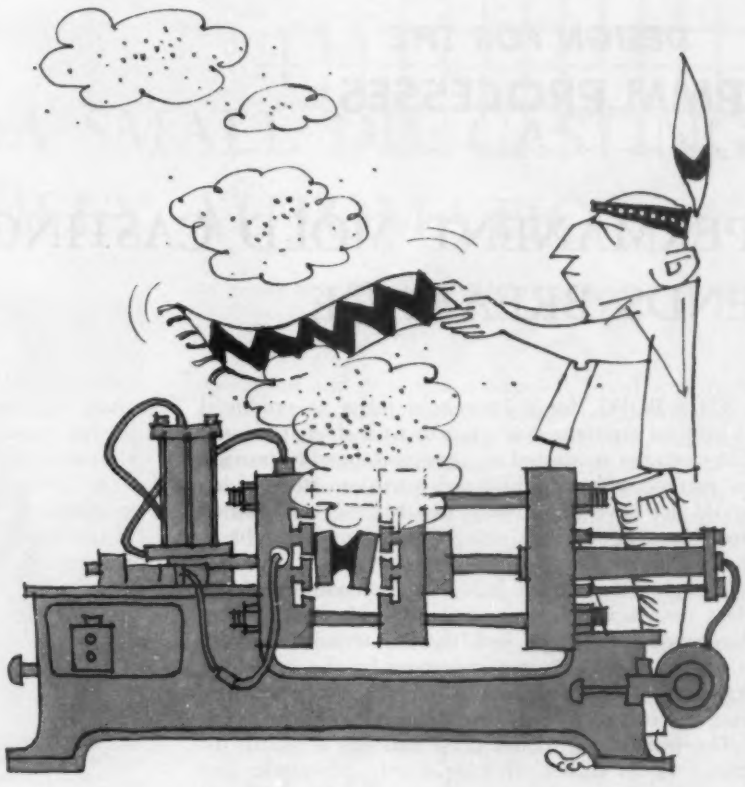
The extrusion process for making tube plates was considered and given to Precision Extrusions, Inc. of Bensenville, Illinois. The engineers at Precision produced an acceptable method.

Aluminum alloy X-8001 was found to be the best metal. It has superior extrusion characteristics, excellent thermal conductivity and unusually high resistance to corrosion by the distilled, deionized, 425°F water used for cooling.

The tube-plate shapes were extruded on a 2200-ton horizontal press, stretch-straightened, and cut into 36-inch lengths. Final assembly was completed at Argonne.

Now that Argonne has finished the initial research on several methods of manufacturing an item such as the atomic reactor tube plate, other industries may find it profitable to put the knowledge to work.

Accurate extruded parts at low operational costs produced in large or small quantities of heat conducting metals, with limited corrosion tendencies, is one method more how the PMM processes point the way in today's progressive industries.



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Circle No. 93 on Reader Service Card

DESIGN FOR THE
PMM PROCESSES

PERMANENT MOLD CASTING ENDS BREAKAGE

THIS BOWL for a household mixer is produced as original equipment in glass or as a steel stamping. The customer requested an aluminum bowl to provide his market with an additional, premium item which would not have the obvious disadvantage of glass or steel; breakage in the case of glass, and weight in the case of steel.

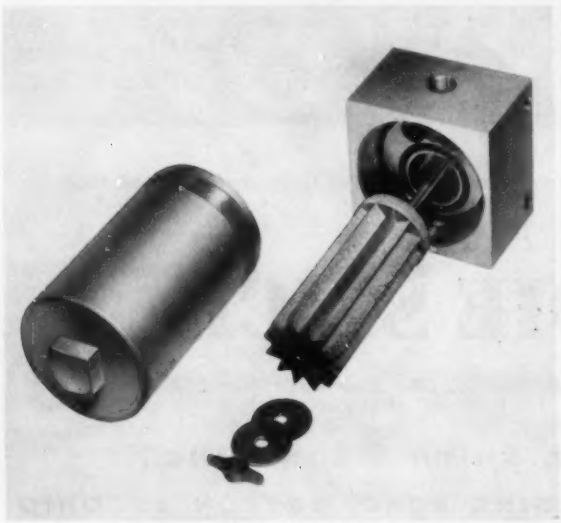
The aluminum bowl followed the contours of the glass design which presented a problem in casting the bayonet lug type lock threads without the use of a sand core. This was overcome by the use of an ingeniously designed tulip core which opens away from the casting as it is being ejected from the mold.

The bowl is 6¾ inches deep and has a mouth diameter of 8¾ inches. It weighs only 2 pounds, and is produced by Monarch Aluminum Mfg. Co. of Cleveland.

SINTERED FILTER STOPS ALL THE DIRT

BY USING POWDER METALLURGY and extrusions, GPE Controls, Inc. developed a 40 micron filter element for long, trouble-free life.

The filter has an active area of 35 sq. in. and is designed to operate at 1000 psi. It carries ¾" standard pipe connections. The filter element is made from bronze powder and is threaded to an extruded aluminum head. The bowl is an aluminum forging.



The special design assures that there will be no disintegration of the element even with a pressure drop of 400 psi.

The reusable feature of the filter is another important advantage. When the pores become clogged, the bowl is unscrewed, the filter removed, cleaned, and replaced. Washing with solvent may be enough to clean the filter or reverse air blowing may be used.

The extruded aluminum head is another economy. Threaded connections and flow channels are easily and inexpensively machined and the finished head is more economically produced than the forging originally designed for this filter.

Where additional capacity is needed, for example on a companion ¾" pipe connection unit, two of the sintered filter units are used in parallel.

Because of its non-corroding materials, this filter can be used on a wide variety of liquids and gasses such as petroleum, various esters, glycol, synthetic hydraulic fluids, silicones, water, or air.

more design ideas, page 89

ULTRA SMALL DIE CASTING . . . FULLY AUTOMATIC

BY JOSEPH SAKS, *Director of Sales, Gries Reproducer Corp.*

PARTS MANUFACTURERS are challenged today by the design trend toward compact assemblies made with miniature parts. Such parts frequently are of intricate shape and must be produced to extremely close tolerances to satisfy assembly and performance requirements. With production runs of hundreds of thousands or even millions of "super tiny" components, handling, assembly and over-all production costs pose a formidable barrier.

Gries Reproducer Corp., utilizing unique fully-automated equipment which eliminates secondary operations and produces a completed part with each casting cycle, has introduced a new engineering concept into the precision metal molding field. Parts are die cast, trimmed, machined – even assembled – in a *single* cycle at rates exceeding 100 cycles per minute. Because of GRC's "single-cavity" technique, consistent part-to-part uniformity is maintained. This is automatic die casting – a process which enables intricate, close tolerance, tiny parts to be produced at minimum cost.

The smaller the part to be made, the more attractive

Ratings: Lowest Number Indicates Most Desirable Ratings	Comparison Of Mass Production Metal Fabricating Methods Commonly Used For Parts Ranging In Size From 10M pcs/lb. To 250M pcs/lb.	Automatic Die Casting	Investment Casting	Powder Metallurgy	Extrusion Plus Machining	Screw Machine	Stamping	Heading	Eyelet Drawing
RELATIVE COST & PRODUCTION FEATURES	Production Speed	2	6	4	7	3	1	2	1
	Tool Cost	4	3	3	3	1	3	2	4
	Relative Ease Of Applying Electroplated Finish	3	4	5	2	2	1	1	1
	Scrap Loss	2	4	1	4	5	4	2	3
	Production Steps	1	4	3	3	1	1	1	1
	Need For Deburring	2	5	1	4	3	2	2	3
RELATIVE DESIGN FEATURES	Flexibility Of Design	1	1	3	4	5	6	6	7
	Feasability Of Producing Complete Part In The One Primary Operation	1	2	3	5	3	3	4	4
	Minimum Size Of 1 Piece	1	3	4	4	1	2	3	3
	Ease Of Holding Close Dimensions	1	3	2	4	1	4	3	3
	Surface Finish Without Secondary Operations	2	4	2	3	2	1	2	1
	Feasability Of Producing Parts-Thin Sections	2	2	3	2	1	1	4	1
	Degree Of Parts Uniformity	1	3	2	5	3	3	3	2
	Choice Of Material	5	1	1	3	2	2	2	3
	Overall Production And Design Advantages	**1**	**4**	**4**	**6**	**2**	**3**	**4**	**5**

This table is a guide for preliminary evaluation of those fabricating methods which are best suited to obtain the end requirements of economy of production and product performance. Ratings are based on parts produced with average requirements for shape tolerance and mechanical properties. "One" is best.

automatic die casting of zinc alloy becomes. Undoubtedly there is a lower size limit beyond which the process developed by GRC becomes impractical, but it has not yet been reached. With few exceptions, all the parts described here weigh less than one ten-thousandth of a pound, and they represent only a sample of the tiny parts produced or currently in production.

Many tiny parts of simpler design have been produced as one-piece zinc alloy die castings by merely changing the material specifications. A few examples are watch crowns and center posts, tiny hollow-end rivets, and precision pinions.

Why Automatic Die Casting

To predict whether automatic die casting is likely to be an advantageous production method for a specific part, the designer should evaluate the production and performance requirement peculiar to the part. The table of production process comparisons is helpful in such evaluations, although it must always be kept in mind that this table shows an order of preference which is *generally* true, and specific re-requirements may change that order.

For example, it is generally true that automatically die cast zinc alloy parts can economically replace brass screw machine parts if production of the brass part involves a scrap loss of 50% or more. But where only 2000 parts are to be produced, tooling cost will become a controlling factor and scrap loss a minor factor.

ECONOMY PLUS PRECISION

What is probably the smallest die casting ever made was produced by high speed automatic techniques. This is a wedge pin (figure 1) which fastens a watch hairspring into the eye of its center post. An elongated truncated cone with a rounded nose end, it has a length of 0.085 ±0.002 in., a major diameter of 0.018 in., and a minor diameter of 0.011 in. Both diameters are held to a tolerance of 0.0005 in. To make a pound of these wedge pins takes well over a quarter of a million pieces.

Another watch part of comparable size — a stem bearing bracket (figure 2) — is made by the same process. Much larger than the wedge pin (it takes only 12,000 brackets to make a pound), it is also more complex. Despite its tininess, this part has 19 principal dimensional specifications. Two of the side surfaces follow precise curves, the throat of the bearing must be accurate to half a thousandth, and even the projecting rivet lug has a precisely-controlled depression. It is difficult to even tally up the number of operations which would be required to make this part by machining, and it is certain that even a skilled craftsman could not meet specifications consistently. Automatic die casting can produce this stem bearing bracket quickly, with negligible reject rates, and most important — economically.

Figure 1. Turned out in volume lots by Gries Reproducer's special automatic equipment, these wedge pins are considered to be the smallest parts ever produced by die casting. Used in a watch hairspring assembly, the major and minor diameters of these truncated conical parts are held to tolerances of 0.0005 inch.

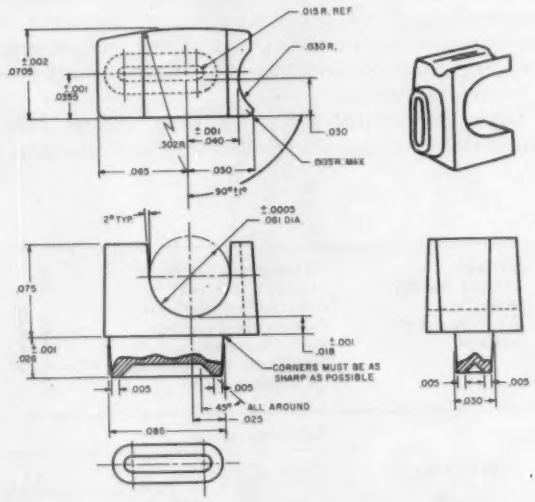


Figure 2. Tiny stem bearing brackets (insert) for watches are produced accurately and economically by automatic die casting. The numerous dimensional specifications and close tolerances listed on the blueprint emphasize the flexibility of this fabricating technique.

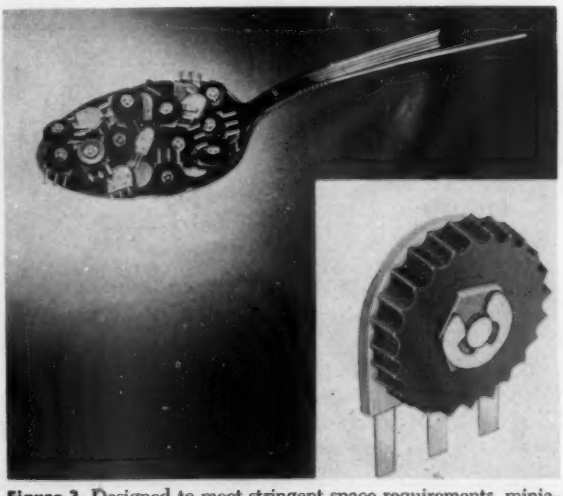


Figure 3. Designed to meet stringent space requirements, miniature die cast shafts and bushings (insert) form the control center of these 75 variable resistors are shown in a teaspoon. Photo: Centralab, Division of Globe-Union, Inc.

ELECTRONICS PARTS

Now that many electronic units are being built on a scale approaching watchmaker's standards, it is not surprising to find tiny parts for a hearing aid volume control (figure 3) in about the same category as the watch parts described. Two such parts — a "shaft" and a bushing — have maximum dimensions of just under 9/64 and 1/8 in., respectively. The "shaft" (9500 parts per pound) is a button-like disc with a fastening lug on the bottom, a projecting tapered shaft on which the bushing rotates, and a stop lug to limit rotation. Equally complex, though even smaller (21,000 parts per pound), the slotted bushing has a hex nut section and has an extension which engages the stop. Together, these two parts form the mechanical center of the volume control potentiometer. In addition, the slot arrangement of the bushing carries and makes an electrical connection with a phospor-bronze slider arm which is the variable tap.

Another electronics part, complex in shape, is a socket adapter (figure 4) for an unusual pin and socket-type connector. With a specified wall thickness of only 0.005 in. ± 0.002-0.000 in., this little cylinder incorporates probably the thinnest major cross-section ever die cast. The adapter also has precise dimensions of length and inner diameter. For instance, one size has a total length of 0.169 in. and an outside diameter of 0.102 in. Well over 10,000 of them are required to make up a pound.

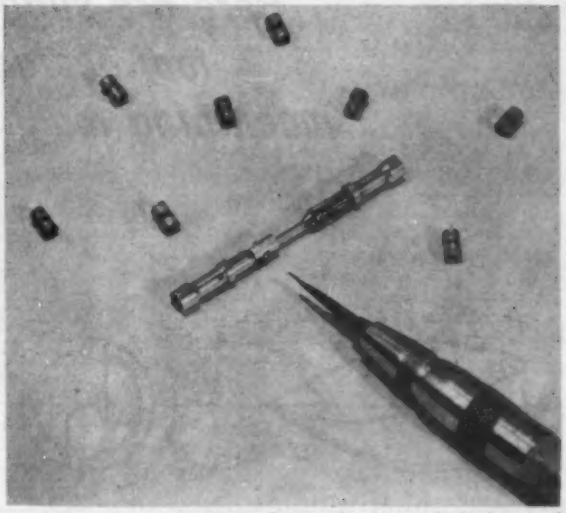


Figure 4. Tiny zinc socket adapters have a wall thickness of only 0.005 in. – probably the thinnest section ever die cast. Used in the Burndy Hyfen pin and socket assembly, these precision units prevent over-size probing and help to maintain reliable electrical conections.

STRENGTH FOR COMPLEX PARTS

One of the giants among these small parts is the drive screw (figure 5) of an inexpensive mechanical pencil. A little over ¾ in. long, it weighs 142 milligrams. A pound contains about 3200 parts. The major portion of the size and weight of these drive screws is taken up by a long thin rod which fits in the lead tube of the pencil and drives the lead forward when the screw is rotated. Since there is no room to waste inside a pencil, a single projection acts as the thread of the drive screw. Covering less than 90 degrees of arc of one turn, this tooth not only does the light duty of advancing or retracting the lead, it also must bear the whole load of the writer's pressure.

Although a little larger than the majority of tiny parts described in this article, the pencil drive screw requires the same precision, on the same miniscule scale. The complex shape in the region of the single thread portion of the part, for example, must be held to detailed dimensional specifications. Automatic die casting for this part was the only practical choice in view of the requirements of shape, precision, and the low selling price of the finished pencil.

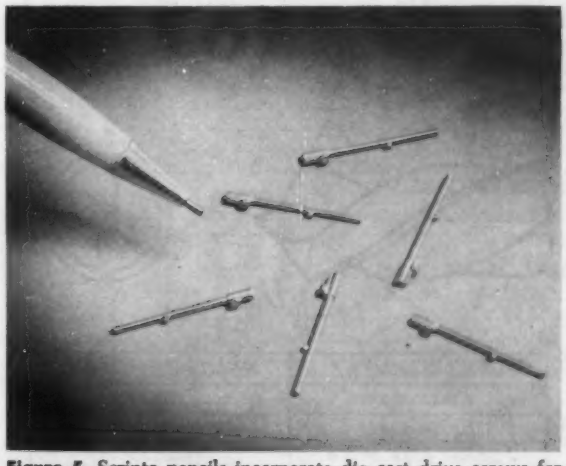


Figure 5. Scripto pencils incorporate die cast drive screws for rugged, low-cost performance. A single thread must withstand pressure exerted by the writer, and also advance and retract the lead.

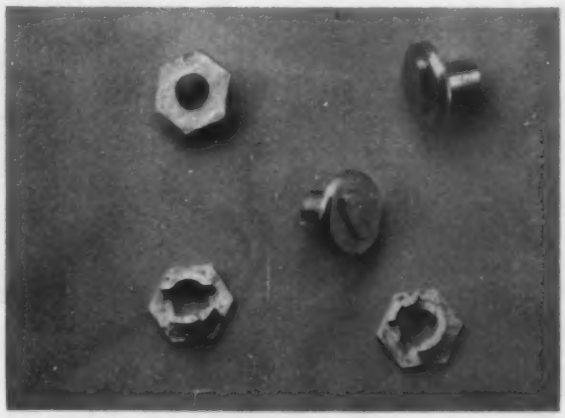
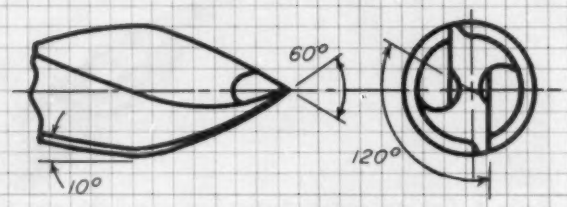


Figure 6. The two die castings which are the heart of the potentiometer shown in figure 3.

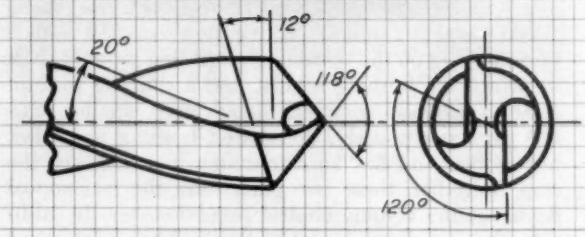
Here are suggested tool designs for machining magnesium

use these PMM **Design Tips** for lower costs -better products



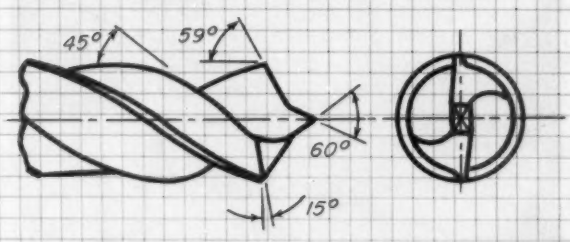
DRILL ELEMENT	RECOMMENDATION
Point angle	60°
Helix angle	10°
Chisel edge angle	120 to 135°
Web	Thinned at point
Corners	Rounded

Sheet drill data



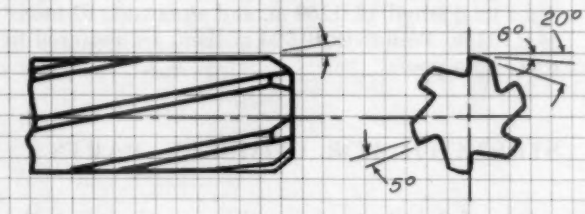
DRILL ELEMENT	RECOMMENDATION
Point angle	70 to 118°
Helix angle	10 to 30°
Chisel edge angle	120 to 135°
Relief angle	12°
Corners	Rounded
Flutes	Polished

Shallow hole drill data



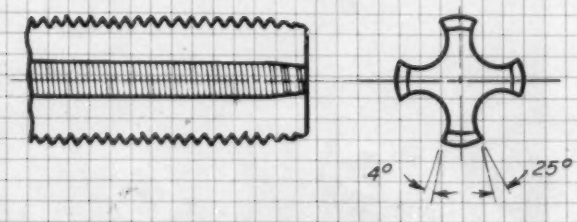
DRILL ELEMENT	RECOMMENDATION
Point angle	118°
Helix angle	40 to 50°
Chisel edge angle	135 to 150°
Web	Constant thickness
Flutes	Open and polished
Point	118° plus spur

Deep hole drill data



REAMER ELEMENT	RECOMMENDATION
Helix angle	0°(straight) or 10°
Rake angle	5 to 8°
Relief angle	4 to 7°
Clearance	15 to 20°
Margin	0.010 to 0.025"
Flutes	4 to 6

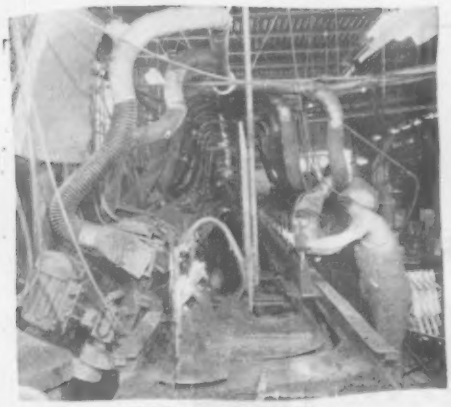
Reamer for use on magnesium



TAP ELEMENT	RECOMMENDATION
Rake angle	10 to 25°
Heel rake angle	3 to 5°
Chamfer	2 to 3 threads
Lands	Cylindrical & narrow
Flutes	2 to 4

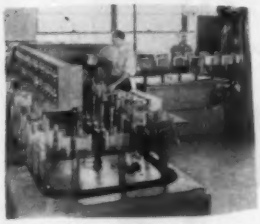
Tap for use on magnesium

COURTESY OF THE DOW CHEMICAL COMPANY



AUTOMATIC BUFFING

TRIMMING



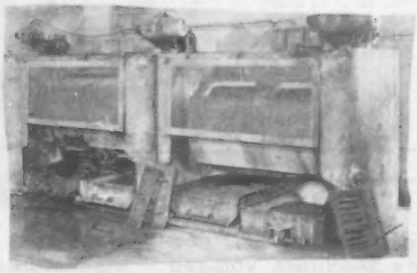
AUTOMATIC PAINTING

The specialized finishing metals, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here.

PMM

FINISHING SECTION

NEW FINISHES FOR MAGNESIUM PAGE 69



BARREL FINISHING

SPRAY PAINTING

PLATING

HAND BUFFING

This includes all secondary operations which convert a raw casting to a finished casting.

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- CLEANING

10 to 100 Times FASTER!

7 SIZES FOR EVERY JOB REQUIREMENT

Model	Tub Capacity	Tub Size, Inside		
		Length	Width	Height
VT-70	¾ gallon	7″	4¾″	6″
VT-71	1 cu. ft.	12″	12″	12″
VT-72	2½ cu. ft.	15″	16″	18½″
VT-75	5 cu. ft.	31″	17″	19½″
VT-77	7 cu. ft.	31″	17″	22½″
VT-712	12 cu. ft.	35″	25″	30⅜″
VT-717	17 cu. ft.	47″	25″	30⅜″

New VT-72 Vibrasheen being unloaded into optional hoist-pan. Note convenient height of controls.

ANOTHER REPORT FROM THE ALMCO ALBUM OF NEW PRODUCTS

IT'S A FACT! With the seven (7) new ALMCO Vibratory Machines, you can expect finishing time cycles 10 to 100 times faster than with standard horizontal barrel finishing equipment. It's a significant production break-through, made possible by creating constant vibratory motion to activate the entire mass of media and parts in the finishing container, as compared to only 20% activation with conventional barrel finishing methods.

The uniform vibratory motion of the media in recessed areas, blind holes and small I.D. dimensions make it possible to obtain optimum results on a multitude of applicable parts with intricate configurations that can not be completely processed in standard horizontal barrel machines.

What's more, this amazing metal finishing machine only requires 50% of the floor space that is taken up by any other machine of this type with a similar capacity. Time and motion is at the absolute minimum with all convenient operating conditions.

Tub features. Holds a 2½ cu. ft. load of parts and media. Equipped with vibrating mechanism adjustable for impact range of from 600 to 2550 lbs.; has a vibration frequency of 3380 rpm with variable drive optional. Pivots through 180° arc. Lined with tough ⅜″ plastisol. Quick-acting cam-lock drain door facilitates flushing of tub.

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Circle No. 79 on Reader Service Card

New Design Concepts

BLACK CHROMIUM PLATING

BLACK CHROMIUM is hard, durable, and easy to apply. It gives decorative finishes, reflects light and heat, and has emissive properties.

Solvay Process Div. of Allied Chemical Corp. has developed an electroplating bath for direct plating of black chromium onto any conductive material in standard electroplating equipment.

The bath is basically chromic acid and a fluorine-bearing catalyst ion. The chromic acid concentration should range from 200 to 300 g/1; the fluorine ion from a chromic acid/fluorine ratio of 125:1 to 4000:1.

FLUORINE COMPOUNDS

You can use different fluorine compounds to add the fluorine ion. For example, use these concentrations for a chromic acid solution of 200-300 g/1:

Compound	Concentration (g/1)
Fluosilic acid	0.125 to 0.50
Fluoboric acid	0.125 to 1.00
Ammonium fluoride	0.125 to 1.00

You can also use hydrofluoric acid and the fluorides, fluoborates, or fluosilicates of lithium, sodium, potassium, calcium, barium, and magnesium. For any of these, adjust the fluorine ion concentration to the desired ratio. Make sure the fluorine compounds do not contain sulfate or chloride ions.

Although you can deposit the chromium onto any conductive surface, you get best adhesion and most uniform black over nickel. So, for any other base metal, first apply a nickel strike.

Bath and rinse water should be distilled, deionized, or catalyst-free. Keep bath temperature at 80° to 95°F. Best current density is between 125 and 450 asf. Use lead anodes and standard bright chromium plating equipment. Plating time varies with chromic acid and fluoride ion concentrations, bath temperature, and current density. Generally, 1 to 5 minutes gives a hard, wear-resistant deposit. Increase time for thicker coatings.

EASY TO CONTROL

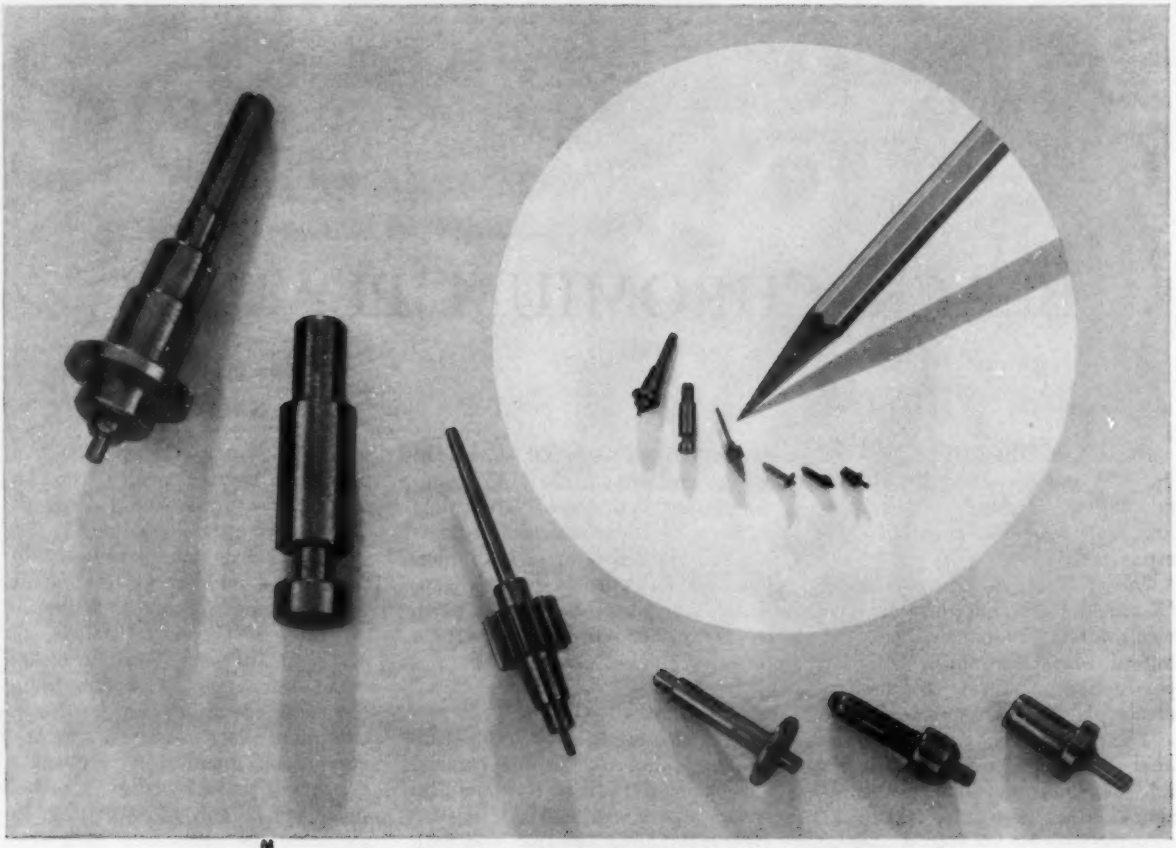
The process is easy to control. While it's best to determine catalyst ion concentration by chemical analysis, you can check it with a Hull cell. Check chromic acid with a hydrometer.

Because black chromium can be wet with water and oil, you can use it as a bearing surface. You can also apply supplemental films of oil, wax, or organic coatings.

Table I lists the plating conditions for a number of test panels of different basis metal. With the exception of the nickel panels, all other metals were given a nickel strike before the black chromium was applied. Zinc can be black chromium plated as readily as any other basis metal if it is given a copper strike followed by a nickel strike before chromium plating. In all cases the chromium bath was free of catalyst ions other than SiF_6.

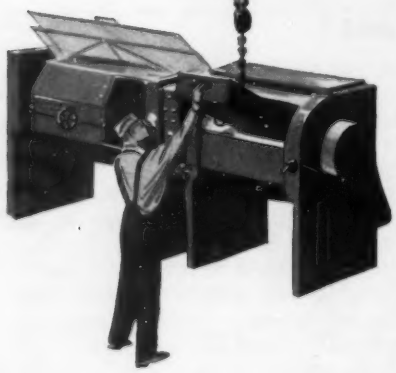
TABLE I

Example No.	Basis Metal	CrO_3 g/L	Catalyst	Catalyst Concentration g/L	Time	Temp.	Current Density asf.
1	Nickel	125	H_2SiF_6	0.25	6 min.	90° F.	300
2	Brass	250	H_2SiF_6	0.125	6 min.	90° F.	300
3	Brass	250	H_2SiF_6	0.875	6 min.	90° F.	250
4	Steel	250	H_2SiF_6	0.25	5 min.	90° F.	300
5	Steel	250	H_2SiF_6	0.5	5 min.	90° F.	300
6	Steel	250	H_2SiF_6	1.0	5 min.	90° F.	300
7	Brass	250	H_2SiF_6	1.25	6 min.	90° F.	250
8	Nickel	500	H_2SiF_6	0.125	6 min.	90° F.	250
9	Nickel	125	NH_4F	0.50	5 min.	90° F.	300
10	Nickel	250	NH_4F	0.125	5 min.	90° F.	300
11	Nickel	250	NH_4F	1.0	5 min.	90° F.	300
12	Nickel	125	NH_4F	1.0	5 min.	90° F.	300
13	Nickel	250	NH_4F	0.25	5 min.	90° F.	300
14	Nickel	250	NH_4F	0.25	5 min.	90° F.	450
15	Nickel	125	NH_4F	0.5	5 min.	90° F.	150



COMPARISON PHOTOGRAPHS OF SMALL PARTS GREATLY ENLARGED TO SHOW RESULTS OF PRECISION BARREL FINISHING

FROM TINY SPECKS OF METAL *to super castings...*



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New Design Concepts

STOP CORROSION ON MAGNESIUM

Progress report on new developments in magnesium alloy finish

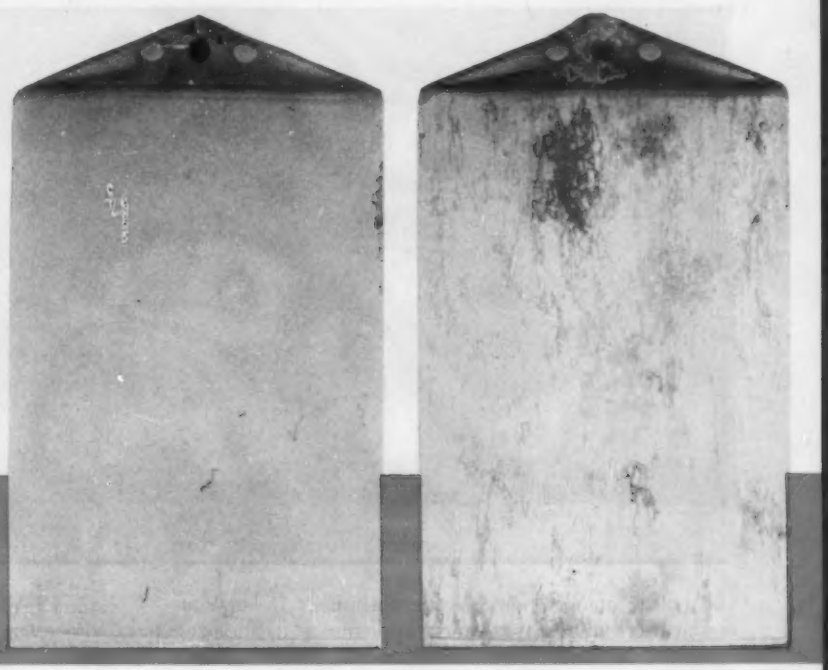

FIG. 1—CLEAR ANODIZE was applied to left die cast panel. Both panels received coats of clear baked enamel. The test results of a 20% salt spray, applied for 510 hours, are evident. Left panel shows little filiform or "worm-tracking" type of corrosion.

By P. F. GEORGE

The Dow Metal Products Company—Midland, Michigan

EIGHT RECENT DEVELOPMENTS in protective magnesium finishes are discussed in this article and will help keep you on top of the field. Procedure details are minimized. Emphasis is on remarks as to properties of new finishes, and their effects on the various markets. This up-dating is necessary because of the many new magnesium alloy finishes introduced every year.

Some of the eight items are not new. In this report only the latest progress is discussed.

ELECTROLESS NICKEL

As was first reported to the Magnesium Association in April, 1958 by H. K. DeLong, electroless nickel is a process for plating nickel directly onto magnesium without electrical current.

Greatest advantage is that electroless nickel coating plates uniformily over all surfaces of complicated shapes such as recesses, cracks, porosity, drilled holes, and bottom of threads inside tubes.

Electroless nickel has many advantages. Its hardness and abrasive resistance can be made similar to chrome plate. It requires less set-up, takes less technical know-how to operate, plates over inserts and dissimilar metal assemblies, and recently has been found to improve the fatigue strength of magnesium alloys.

PORCELAIN ENAMELING

Two porcelain enamels have been used successfully on the aluminum alloys. The enamels are (1) duPont (lead oxide type) and (2) 3M (lithium phosphate type). Firing temperature of each is just below 1000°F. which makes it possible to use them on most magnesium alloys. It does not include low melting phase alloys such as AZ63, AZ91 and AZ92. Pretreatment to assure good adhesion has been worked out for most of the alloys, such as wrought alloys AZ31, KH31, and HM21, and the cast alloys EK30, EZ33, ZE41, and HK31.

Adhesion and resistance to impact values are equal to standard coatings on 61S aluminum.

Tests on the duPont enameled magnesium coatings show excellent corrosion protection. A 500-hour salt spray on panes with bare edges showed little edge corrosion. There was no noticeable spalling or undercutting due to corrosion at the edges. Atmospheric tests both in industrial and rural exposure have shown no corrosion in the first six months of exposure.

Lithium phosphate enamel, because of its non-toxic properties, is applied to cooking utensils. Tests with a magnesium griddle show that the coating will stand repeated heating and cooling of cooking and washing in automatic dish washers.

The coatings are not now used in production. They are expected to be used on high temperature engine parts, signs, heating panels and cooking ware.

CLEAR ANODIZE (See fig. 1)

Two modifications have been made in the Dow 17 anodizing treatment. These are the clear anodize and the anodize impregnation process.

A clear anodize requires only 40 volts for a very short time. Result is a thin transparent coating in contrast to the green opaque deposits of the standard Dow 17 procedure.

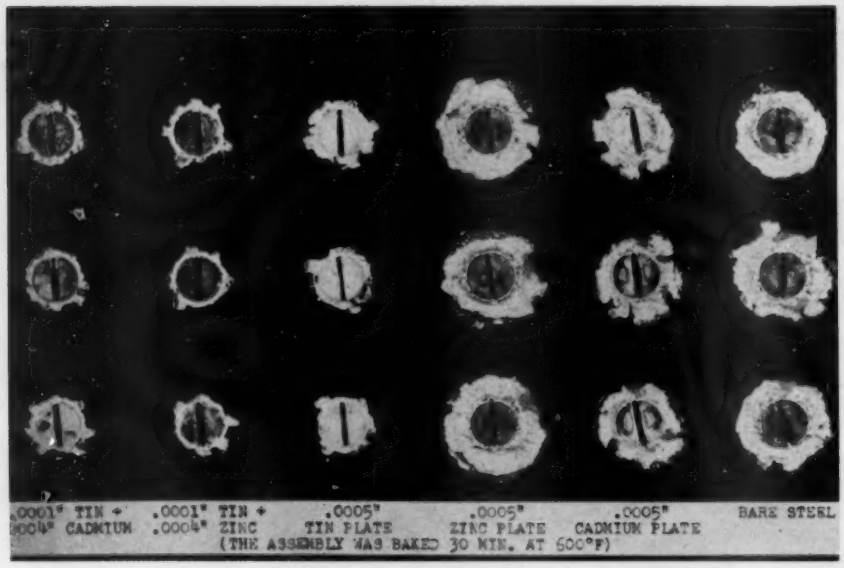
.0001" TIN + .0001" TIN + .0005" .0005" .0005" BARE STEEL
.0004" CADMIUM .0004" ZINC TIN PLATE ZINC PLATE CADMIUM PLATE
(THE ASSEMBLY WAS BAKED 30 MIN. AT 600°F)

FIG. 2—TEST RESULTS show effectiveness of tin plating. A magnesium plate was preheated to 600°F. Various platings listed were applied to fasteners. Far right screws are bare steel. After 200 hours in salt spray, the tin plate showed best (third from left).

A clear baked enamel is then applied. It becomes an attractive finish similar in appearance to the wire brushed or clear anodized aluminum. Some surface preparation is generally required, especially on castings. It is possible to get either a high or low luster appearance. Color variety is possible through use of tinted or dyed clear enamels.

For future commercial application, the process could well be used instead of an electroplate. Costs would be lower, corrosion protection higher.

The clear enamel finish has been used commercially on a die-cast tape recorder reel. After two years, it had a good metallic appearance and still maintained good corrosion protection. Figure 1 shows pictorially how well the worm-tracking corrosion effects are eliminated.

DOW 17 ANODIZE IMPREGNATION PROCESS

The Dow 17 process combines the sealing of castings' porous areas with the formation of a protective paint base. A dwell period at the end voltage of the standard Dow 17 process (either the light or heavy coating) completely seals porosity so it will withstand air or water pressure of 40-lbs. or more.

Advantage of the process: (1) impregnation and coating are both done at once, and (2) impregnation will stand high temperature, high humidity, hot engine oil, gasoline, kerosene, etc.

FERRIC NITRATE BRIGHT PICKEL

This new treatment (Ferric Nitrate Pickel) will bright pickle both cast and wrought magnesium alloys. It replaces Dow 15 and Dow 16 bright pickles. Advantages are, (1) lower cost, requires less replenishing, (2) less apt to stain in rinsing, and (3) is an all-purpose pickle for all alloys.

The treatment leaves a bright surface, also a thin chromate film that offers good shelf life and provides a good base for clear baked enamels — still prevents the "worm tracking" type of corrosion under the clear enamel.

It's a natural for ladders, clothes reels, furniture or other uses where wrought magnesium is left unpainted or covered with a clear enamel.

TIN PLATED FASTENERS

Progress has been made in the protection of magnesium in galvanic couples. In general, corrosion problems with magnesium come from galvanic couples especially if an assembly with dissimilar metals has to pass a salt spray test.

Corrosion compatibility of various dissimilar metals can be lined-up as follows: worst offenders are steel, stainless steel, monel, the aluminum alloys containing copper, titanium, nickel, copper and brass. All are considered non-compatible with magnesium. More compatible are zinc, cadmium and tin. Magnesium with aluminum alloys 6061, 5052 and 5056 are almost compatible.

In magnesium assemblies, cadmium plated fasteners have been considered the best. Tin has been found to be more compatible than either cadmium or zinc. Only a 0.00025-inch tin plating is required and it does not corrode or rub off as fast as cadmium, leaving bare iron. Figure 2 compares corrosion compatibility of cadmium, tin and zinc plating, also bare steel, with magnesium.

NEW ORGANO-TIN INHIBITOR

By adding an organo-tin compound (which replaces zinc chromate) to paint primer, galvanic corrosion of magnesium coupled to a dissimilar metal is inhibited. Best tin compound so far is tributyltin oxide. It has a slight water solubility. If corrosion starts, the cathode of the cell is automatically plated with tin. This inhibitor is much more effective on galvanic couples in salt water than chromates.

For instance, if 15% tributyltin oxide is added to Unichrome AP10 clear primer without the chromate and compared with the regular AP10 primer with zinc chromate, the results are quite startling. Figure 3 shows very little corrosion even on scribed areas where 15% TBTO is used.

COMPATIBLE ALUMINUM ALLOYS

More effort has been placed on the study of corrosion compatible aluminum alloys, as was emphasized by the report Dr. J. L. Nichols presented at the April, 1958 Magnesium Association Meeting. The re-

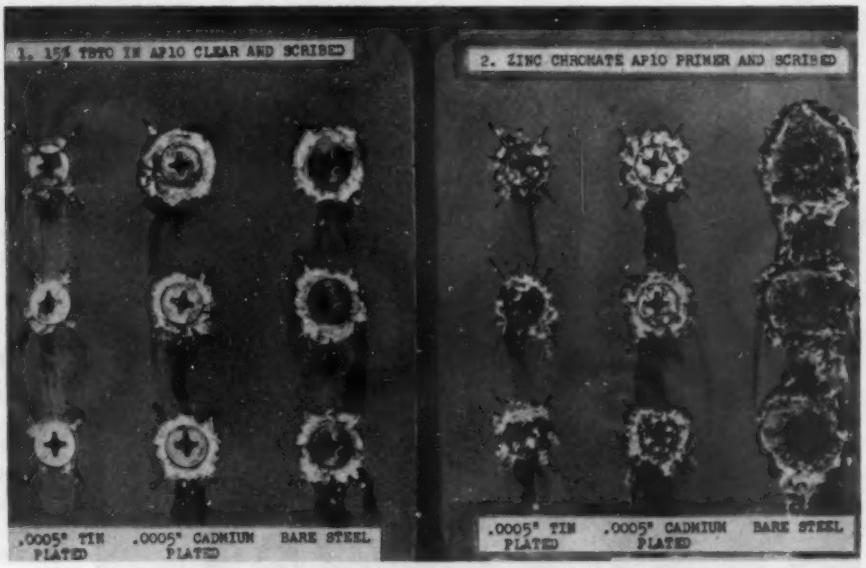

FIG. 3—DEFINITE RESULTS were obvious when the new organo tin inhibitor was applied. Tin, cadmium and bare steel fasteners were used in both plates. An overall coat of API0 primer was applied and fasteners were scribed. Difference was that on the left plate a 15% tributyltin oxide inhibitor was used, the right plate, zinc chromate. Tin plate showed best results in both instances. There was considerably less corrosion on the 15% TBTO plate after 200 hours in salt spray.

port showed the effects of iron in aluminum and its alloys when galvanically coupled to magnesium.

Figure 4 illustrates what effect the addition of magnesium has on aluminum alloy that contains iron. As greater quantities of magnesium are added, the harmful effects of the iron are lessened.

From the curves in Figure 4, it seems that 5056 aluminum will tolerate the most iron, and is the most compatible with magnesium. Experience shows this to be true. However, with the rapid increase in the use of new high temperature magnesium alloys (HK31 and HM21), it was necessary to find the effect on 5056 aluminum alloy heated to high temperatures.

To find the effect, a test was made using four rivets heated to various temperatures. The rivets were:

Rivet	% Mg	Type of Al
1	5.2	99.99%
2	4.3	99.99%
3	5.2	99.90%
4	4.3	99.90%

Sets of these four types were riveted on HM21 alloy. A 200 hour salt spray was applied first, then the heat tests.

Good compatibility of both 4.3% and 5.2% Mg rivets of 99.99% aluminum was shown up to 800°F. At temperatures between 300°F. and 400°F. the 99.90% aluminum rivets proved non-compatible in both 5.2- and 4.3- Mg. content rivets.

Test results point out the necessity for using a high purity 5056 aluminum rivet with magnesium alloys when the assembly is going to be subjected to the 300°F. – 400°F. temperatures. For the 99.99% aluminum rivets, non-compatibility was not visible above 500°F. and below 200°F.

TO SUMMARIZE – the eight items listed and described are only a cross section of the advancements made recently in the corrosion protection of magnesium. It is easy to see that the work in this field is probably progressing as rapidly as at any time in the history of magnesium.

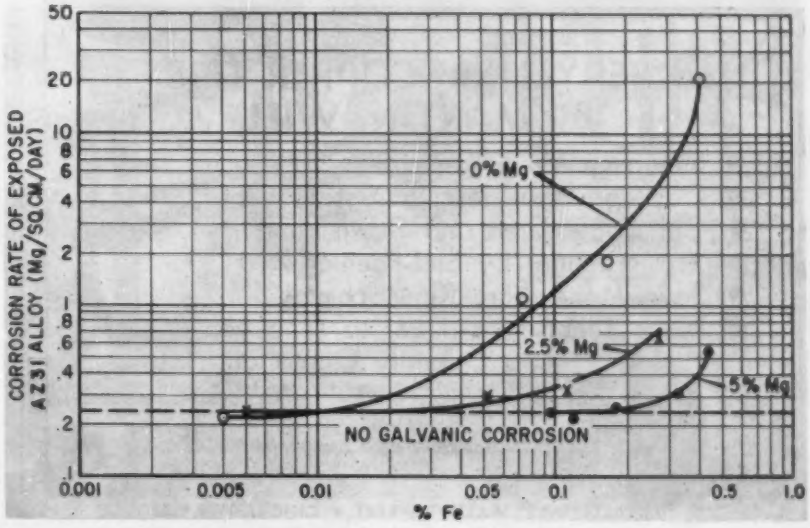

FIG. 4—GALVANIC COMPATIBILITY TOWARD AZ31 ALLOY OF A1 ALLOYS CONTAINING Mg and Fe. With iron present in aluminum, corrosion increased rapidly as is seen by the line marked 0% Mg. Increase of magnesium to the aluminum alloy decreases corrosion. Magnesium counteracts the harmful effects of iron.

NEW SHELL MOLD FOUNDRY

T. B. Wood's Sons Company, Chambersburg, Pa., has completed a new shell-mold foundry to supplement existing facilities.

Advantages of the shell-molding process, say company executives, are closer tolerances and smoother finish than standard castings as well as higher production. Tolerances can be held to 0.002 to 0.005 in. per in. of casting diameter. Machining is often eliminated.

As examples of the savings effected, formerly 3/32 in. of metal was machined from the base of housings for ball-bearing pillow blocks. Today there is only 1/32 in. to grind off, a saving of time and material. A 5-in. diameter sheave, formerly cast in a green-sand mold, is now cast in a shell mold. The saving is 2¾ lb of metal.

Up to eight castings can be made in each shell. Individual castings range in weight from 1 to 45 pounds.

The equipment includes two fully automatic shell-molding machines. Dry sand of AFS fineness 110 is mixed with a thermosetting phenolformaldehyde binder. The shell-forming material is allowed to fall upon cast-iron patterns heated to 450 F. At this temperature the binder becomes plastic and allows a coherent sand shell to be built up around the metal pattern or patterns. This shell is then baked until the plastic has set.

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PRECISION METAL MOLDING

Ejector pins push the shell from the patterns, and the shell is broken into two halves. These must be "glued" together. A measured amount of binder is applied to one of the shell halves through a specially machined template. The residual heat of the shell halves sets the binder. Close parting-line tolerances are maintained by compressing the shell halves while the "glue" is setting.

The molds are stored on edge in racks for transfer to pouring boxes. These travel around the room on an oval conveyor. A bed of gravel is deposited in the box to support the molds, which are then covered with gravel. Three to five molds can be packed in each pouring box. The gravel is fed from an overhead bin by a vibratory feeder.

The shell foundry was located adjacent to the cupola furnaces, minimizing heat loss in molten metal transfer and allowing frequent pourings. The metal is poured at a temperature of 2,600°F to 2,700°F. After pouring, the molds are allowed to cool on the conveyor before being transferred to shakeout. A mechanism inverts the pouring box with a section of the conveyor track. Castings and mold "butts" are separated from gravel and burnt sand on the screen deck of an oscillating conveyor. The castings are placed in skid boxes for transfer to the cleaning room. The gravel and burnt sand ascend on a bucket elevator to an air separator, the gravel being re-used and the burnt sand discarded. The plant is fully mechanized.

CHROMALLOY CORP. APPOINTS RESEARCH DIRECTOR

Dr. Herman Blumenthal has joined Chromalloy Corporation, White Plains, N.Y. as research director of the Chromalloy Division. He had been chief chemist and project leader for American Electro Metal Division of Firth-Sterling, Inc. for almost fifteen years. Dr. Blumenthal's first project will be to improve chromallizing techniques at temperatures above 3000 F. He will concentrate on perfecting a process for chromallizing columbium and its alloys which the company expects to be as good as its W-2 process, now being used successfully for molybdenum.

GABOR BECOMES CHIEF ENGINEER

Charles D. Gabor has recently been appointed chief engineer of Harbison-Walker Refractories Company, Pittsburgh, Pa.

Gabor has been associated with Harbison-Walker since 1941. He has served as a draftsman in the engineering department, in general engineering work, and as a project engineer. In 1957, he was appointed assistant chief engineer.

SMITH HEADS THE CANADA METAL CO., LTD.

National Lead Company has announced the election of Carleton Smith as president of The Canada Metal Company, Ltd., a National Lead Company subsidiary. Mr. Smith succeeds James A. Taylor who has retired after forty-seven years of service.

Mr. Smith joined Canada Metal in 1933 at the Montreal plant. In 1945 he was named assistant manager and in 1948 manager of the Montreal operations. Mr. Smith was appointed general manager of The Canada Metal Company, Ltd. in 1955.

The Canada Metal Company, Ltd. manufactures fabricated lead products; lead oxides; lead and zinc alloys; die castings in aluminum, brass, magnesium and zinc; brass forgings and other brass and bronze products. The principal manufacturing operations of the company are at Toronto, Montreal, Winnepeg, Calgary and Vancouver. General offices are in Toronto.

more industry news, page 82

Hammond OF KALAMAZOO

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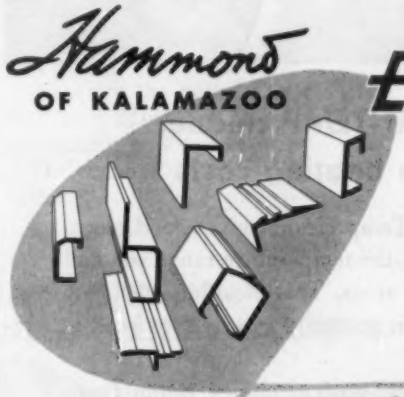
for LOW COST, VOLUME PRODUCTION FINISHING OF EXTRUSIONS, TRIM AND MOULDINGS



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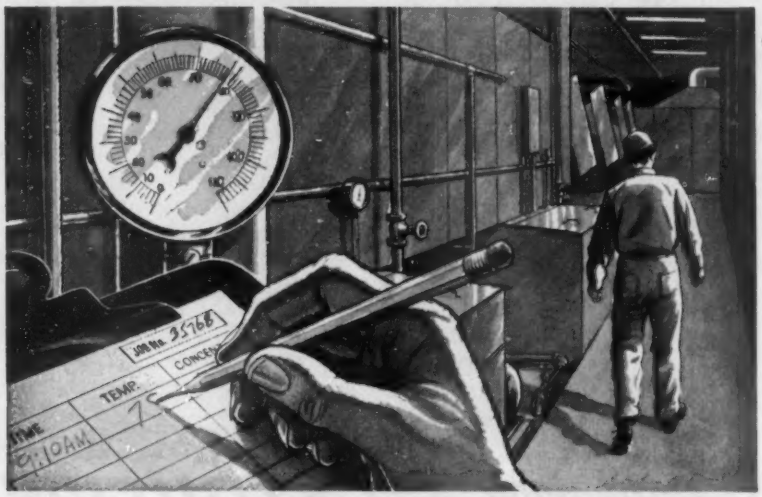

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LETTERS

continued from page 21

ABOUT PLYCAST

Following the requested information—J.J.P., Jan., 1960, page 24, PMM—on the PLYCAST Investment Casting Process, we can inform you, if this is of any interest to the correspondent involved, that the Plycast process is now used in Western Europe by the following firms: Deutsche Edelstahlwerke Aktiengesellschaft (D.E.W.), Deutscher Spinnereimaschinenbau Ingolstadt, GM Pffaf, Af, Aktiebolaget Kanthal, Microfusione Italiana, and Ideal Casements (Reading) Ltd., who are licensed there of and that American patents covering the technique have been accepted by the Patent Office.—Nicolas Herzmark, Paris, France.

ANODIZING DIE CASTINGS

Do you know of any die caster or manufacturer of die castable aluminum who has an alloy suitable for anodizing without discoloring or not being uniform as to finish.—D.D.H.

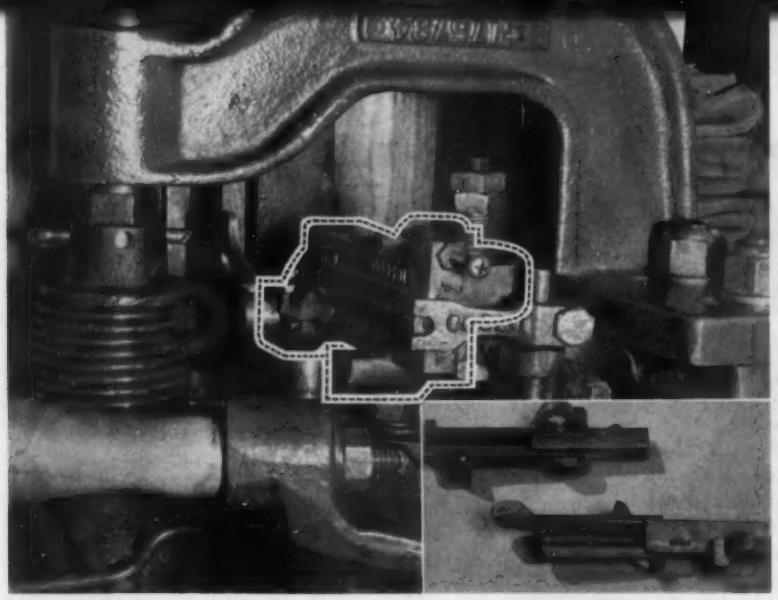
Some die casters have had good luck die casting very high purity aluminum using vacuum die casting techniques. Also some of the primary producers of aluminum are carrying on research to develop a good die castable and anodizable alloy.—Ed.

PLASTER MOLD CASTINGS

We are evaluating the potential of plaster mold casting. We would appreciate any information, i.e. reprints, publications, new sources of information, etc., you could submit to us about this subject.

Your magazine has been an invaluable aid to our engineering department. We appreciate any assistance you can give us on this project.—L.W.T.

There are two general sources of information other than PRECISION METAL MOLDING. These are the literature sent out by the companies who make the castings and the U. S. Gypsum Co., Chicago.—Ed.



THOSE OLD DIES ARE GOOD

TWENTY FIVE YEARS AGO, The Newton-New Haven Co. sold a customer on zinc die castings. What's more they are still making zinc die castings for the same customer and on some parts are using the original dies made a quarter century ago. That may come close to a record.

What are the parts? The Feeler Bed and Slide for the control mechanism on a textile loom.

The original design of the parts called for machined gray cast iron. They were heavy, expensive, and generally unsatisfactory. With the die cast parts much of the machine work was eliminated. Surface finish, as cast, was good (far better than could ever be gotten with cast iron) and dimensional integrity so good that only minor machining such as drilling and tapping had to be done. Even the dove-tail channels were cast to finished size.

Naturally, there was a major cost reduction. Today, the saving is even more impressive. In spite of the increase in cost of raw materials, the reduction in labor charges is so much greater that a change back to an iron sand casting is unthinkable.

Of course there are not many parts where the design stays the same for so long. But where it does, the permanent tooling of the die casting process plus the reduction in machining and surface finishing will show manufacturing savings year after year.

Also, a die casting die is not necessarily obsolete because of a design change. Many minor changes can be incorporated in the old die.

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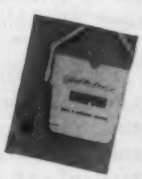

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PROCESSES

4 Die Casting — ALBANY-CHICAGO CO. — 4-page brochure shows the advantages of having one firm to do both zinc die casting and plating.

67 Sinterings — NEW JERSEY ZINC CO. — Technical booklet on pressed brass and nickel silver sinterings gives design suggestions, commercial tolerances, cost factors, alloy compositions, properties.

145 Castings — ALLOY CASTING INSTITUTE — Table lists standard designations and chemical composition ranges for heat and corrosion resistant castings.

146 Shell-Mold Castings — WESTINGHOUSE ELECTRIC CORP. — 8-page technical booklet shows procedures for the shell-mold casting process, includes design and alloy selection data.

147 Castings & Extrusions — DOW METAL PRODUCTS CO. — 12-page brochure describes services and facilities for extruding and casting, includes data on alloy compositions and properties.

MATERIALS & EQUIPMENT

150 Melting Billets — DREIFUS STEEL CORP. — Technical data on melting billets. A range of alloys is available.

151 Metal Powders — METAL POWDER PRODUCERS ASSOC. — 46-page technical booklet lists by grades and types the commercially available metal powders.

152 Hardness — Strength Relations — BABCOCK & WILCOX CO. — Chart relates the tensile strength of steel to its hardness by the various testing systems.

153 Hydrogen Atmosphere Furnace — LINDBERG ENGINEERING CO. — Engineering data on a full muffle, hydrogen atmosphere, hand pusher furnace.

154 Electrical Insulator — MELPAR, INC. — Technical literature on a rigid, light weight, foamed dielectric material that is also an excellent thermal insulator.

155 Stainless Steels — VANADIUM CORP. OF AMERICA — Brochure traces the development of stainless steels from 1797.

156 Thermocouple Protecting Tube — MILLES EQUIPMENT & SUPPLY — Technical literature on an alloyed iron, thermocouple protecting tube.

157 Standard Die Unit — DETROIT MOLD ENGINEERING — 6-page technical booklet on standard unit dies for zinc and aluminum die casting.

158 Thermocouples — CLAUD S. GORDON CO. — Literature on a line of alloy-sheathed, ceramic insulated thermocouples.

159 Magnetic Castings — WESTINGHOUSE ELECTRIC CORP. — 4-page technical brochure lists alloys suitable for magnetic castings, tells how to choose them.

160 Tracer Mill — FAMCO MACHINE CO. — 8-page catalog describes a line of automatic and manual hydraulic tracer mills.

161 Combustion Tube Furnaces — HEVI-DUTY ELECTRIC CO. — 6-page brochure gives engineering data on a line of combustion tube furnaces.

162 Tool & Die — TOOL & DIE INSTITUTE — Directory shows most of the tool and die facilities available in the Chicago area.

163 Refractory Materials — REFRACTORY PRODUCTS CO. — Brochure describes a line of tap hole plug cones, tubes, sleeves, and other refractory materials.

164 Stainless Steel Filters — MICRO METALLIC DIV. — 8-page booklet gives flow rates, particle size removal and other engineering data for porous stainless steel filters.

165 Melting Power Unit — INDUCTOTHERM CORP. — Technical data on a self-contained power unit for high-frequency induction melting, includes a table of melting performance for various metals.

166 Machine Lubricant — ALPHA-MOLYKOTE CORP. — 4-page bulletin describes a lubricant which reduces galling, seizing and metal pickup in high pressure and temperature applications.

167 Metal Facilities — WESTINGHOUSE METALS PLANT — 20-page brochure shows the research, design and production services available.

168 Aluminum Bar Stock — HARVEY ALUMINUM — 8-page booklet lists round and hexagonal hollow aluminum rod and bar stock available, includes mechanical properties, tolerances and specifications.

169 Cutting & Grinding — ENGELHARD INDUSTRIES, INC. — Technical periodical, "Diamond Data", discusses the application of diamonds for cutting and grinding.

170 Diffusion Furnace — LINDBERG ENGINEERING CO. — Technical data on gaseous and solid diffusion furnaces.

171 Epoxy Repair Compound — DEVCON CORP. — Technical data on low cost epoxy tooling and repair compounds.

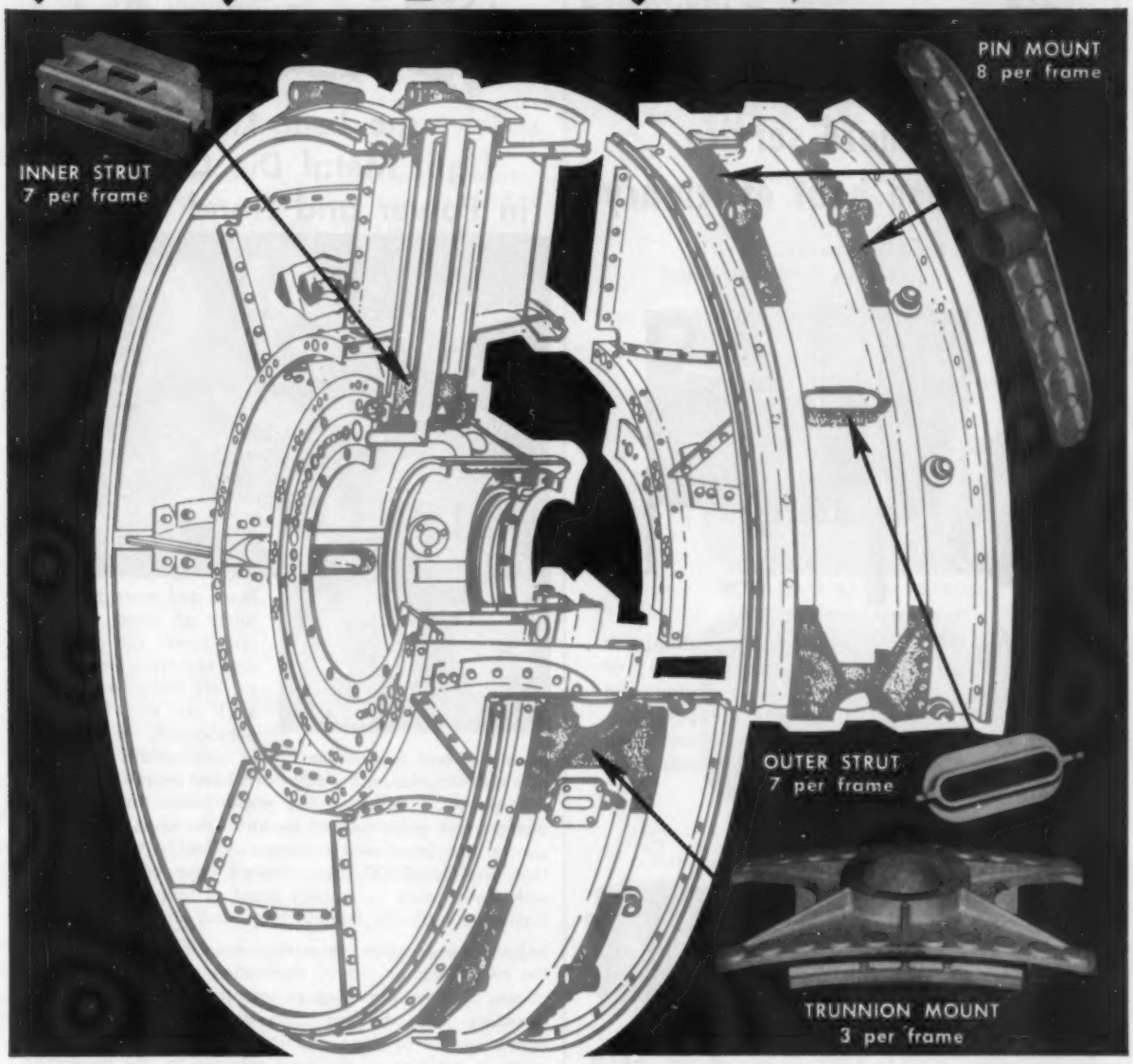
172 Dry Film Lubricant — POLY CHEM, INC. — 4-page brochure shows technical data and uses for a new moly base, bonded, dry film lubricant.

173 Immersion Thermocouple — ENGELHARD INDUSTRIES, INC. — Data on an expendable immersion thermocouple for measuring molten metal temperatures.

174 Impact Tester — TESTING MACHINES, INC. — Brochure describes a motorized machine for Izod, Charpy and tension impact testing of metals.

175 Aluminum Alloys — OLIN MATHIESON CHEMICAL CORP. — 24-page booklet describes the physical properties, fabrication characteristics and cost factors of various extrusion and casting alloys.

continued on page 79



MONO-SHELL castings of A-286 Alloy, poured by DOUBLE-V System, MEET GENERAL ELECTRIC'S REQUIREMENTS for the J79 Engine's Ruggedized Turbine Frame!

Part drawings by Misco, evaluated on-the-spot by General Electric, permitted expedited tooling, production to meet required metallurgical quality, and delivery of castings in record time. These four castings are a vital part of the Turbine Frame of the J79 Engine, which powers the Navy Grumman F11F-1F, USAF Convair B-58, USAF Lockheed F-104, Navy North American A3J, Navy McDonnell F4H, and the CJ-805 Engine which is a commercial version of the J79 design for powering the Convair 880 . . . . . *Send us your inquiries, details of your requirements, or parts for quotation.*

Misco Precision Casting Company

Plants in
WHITEHALL, MICHIGAN
MUSKEGON, MICHIGAN

MISCO

Address inquiries to
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WHITEHALL, MICHIGAN
TWinoaks 3-1515

MONO-SHELL

Sales Offices in Principal Cities

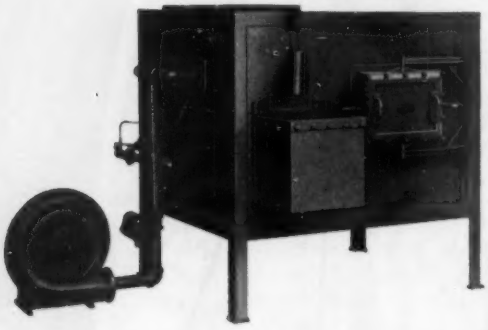
PRODUCERS OF AIRCRAFT AND INDUSTRIAL INVESTMENT CASTINGS

Circle No. 39 on Reader Service Card

DFC Furnaces

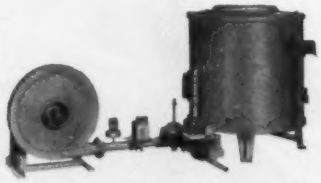
give long, hard service ...increase heat efficiency

1300-lb. capacity— in just 36 sq. ft. of floor space!



REVERB-O-MELTER, reverboratory aluminum melting furnace, available in either stationary or tilting types, gas-fired. Separate charging and ladling buckets allow simultaneous operations, built-in access door for fluxing and puddling. Used for die casting, permanent mold casting, conveyorized production of small sand castings.

Tangential firing— no crucible hot spots!



Rugged crucible and pot type, stationary melting furnace, for melting at temperatures up to 2200° F. in graphite crucibles. Gas or oil fired; adaptable to manual or automotive temperature control as well as flame safety equipment. For melting non-ferrous metals: copper, brass, bronze, gold, silver, etc.

DFC produces a complete line of industrial furnaces designed for simplicity, durability and efficiency.

Denver Fire Clay Company

3033 BLAKE STREET DENVER 17, COLORADO

Please send further information on the following furnaces:

☐ Forge Furnaces ☐ Melting Furnaces ☐ Special Furnaces
☐ Laboratory and Testing Furnaces ☐ Assay Furnaces ☐ Heat Treating Furnaces

DFO-14

Name:.....

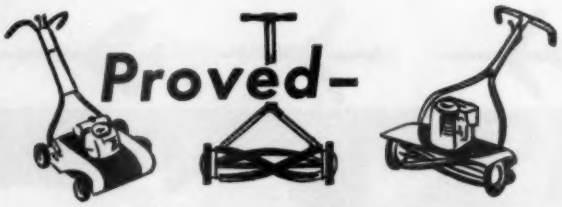
Company:.....

Address:.....

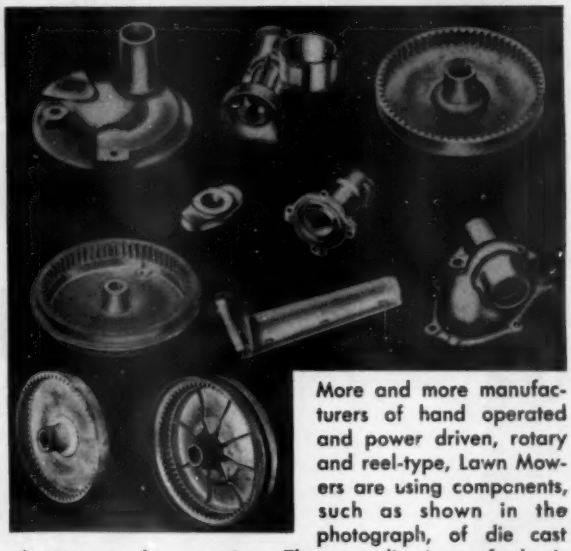
City:..... Zone:..... State:.....

Circle No. 77 on Reader Service Card

Proved-



the Long-Life of Light Metal Die Castings in Power and Hand Mowers



More and more manufacturers of hand operated and power driven, rotary and reel-type, Lawn Mowers are using components, such as shown in the photograph, of die cast aluminum and magnesium. These applications of aluminum and magnesium die cast parts have proved themselves through years of operating experiences. For example: one die cast gear, such as shown in the upper right hand corner, has been used continuously for 10 years. During that time 1,500,000 lawn mowers have been equipped with these gears . . . surely proof of long-life and satisfaction to both the manufacturer and ultimate consumer.

Important production cost savings are effected also through the minimizing or virtual elimination of machining operations, plus the providing of smooth surfaces and design flexibility. Too, shipping costs are reduced due to the lighter weight of these aluminum or magnesium die cast parts. In addition to the gear referred to, the illustration above also includes: wheels, gears, gear housings, shaft housings, brackets, spacers, frames, cutter bar supports, etc.

Let's Talk It Over . . .

LITEMETAL DICAST, INC. is an organization of specialists — men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs — little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large cable spools. Complete facilities for secondary operations are also available.

Write today for literature and design information. Quick action on inquiries.

LITEMETAL DICAST Inc.

A SUBSIDIARY OF HAYES INDUSTRIES

1925 WILDWOOD AVE. • JACKSON, MICHIGAN

PLANT AND EXECUTIVE OFFICES

Circle No. 36 on Reader Service Card

176 Structural Aluminum — REYNOLDS METALS CO. — 24-page booklet gives specifications on warehoused structural aluminum stock.

177 Melting Furnaces — HEVI-DUTY ELECTRICAL FURNACE CO. — 12-page booklet gives specifications on a complete line of non-ferrous metal melting furnaces.

88 Laboratory Services — METAL CONTROL LABORATORIES — 18-page facilities brochure — describes the metallurgical engineering and laboratory services available.

FINISHING

185 Tapping & Drilling — ETTCO TOOL & MACHINE CO. — 6-page catalog gives specifications on a line of units which convert any drill press to multiple drilling and tapping machines.

186 Work Holding Machine — HAMMOND MACHINERY BUILDERS — Bulletin describes a machine for holding odd shaped parts being buffed or polished.

187 Screen Separator — RAMPE MFG. CO. — Information on an automatic, variable speed screen separator with interchangeable screens.

188 Infrared Ovens — FOSTORIA CORP. — 8-page booklet on infrared ovens and components for metal processing, shows typical installations.

189 Welding Aluminum — ALL-STATE WELDING ALLOYS CO. — 40-page technical manual on the welding, brazing and soldering of aluminum, includes government specifications.

190 Anodizing — KAISER ALUMINUM — Information on the KALCOLOR process for anodizing aluminum extrusions by alloying elements within the metal.

192 Barrel Finishing — NORTON CO. — Information on bonded shapes for the barrel finishing of hard-to-reach areas of intricate parts.

193 Painting Masks — CONFORMING MATRIX CORP. — Literature on extremely large magnetized masks for spray painting.

194 Ultrasonic Cleaner — BRANSON ULTRASONIC CORP. — Information on a transistorized, self-contained unit for ultrasonic cleaning intricate small parts.

195 Buff — SCHAFFNER MFG. CO. — Literature on a buff for achieving smooth, scratch free surfaces on ferrous and non-ferrous metals.

196 Drill Press Feeds — BECKETT-HARCUM CO. — Information on a geared head, air powered drill press feed.

197 Finishing Machine — ROCKWELL MFG. CO. — Data on a combination belt and disc finishing machine capable of performing nearly all shop finishing operations.

198 Aluminum Tinning — ALLIED RESEARCH PRODUCTS, INC. — Literature on a new process for the immersion tinning of aluminum parts.

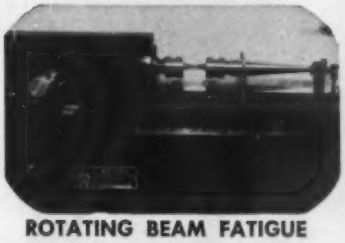
199 Washing & Phosphatizing Units — RAMCO EQUIPMENT CORP. — Bulletin describes monorail and other types of conveyorized, standardized, stage-by-stage power spray washing and phosphatizing units.

So you need a metallurgist...

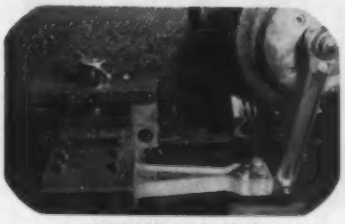
what's your problem?

FATIGUE ?

AXIAL TENSION FATIGUE



ROTATING BEAM FATIGUE



FLEXURE FATIGUE

Fatigue testing is one of our specialties.

Without obligation, send for our brochure and price lists covering complete metal testing and research services. If your problem involves chemical composition, physical-mechanical properties or metallurgical requirements.

Call: LUdlow 8-4161

METAL CONTROL LABORATORIES

INCORPORATED

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HUNTINGTON PARK, CALIF.

The Leading Metallurgical Laboratories on the Pacific Coast

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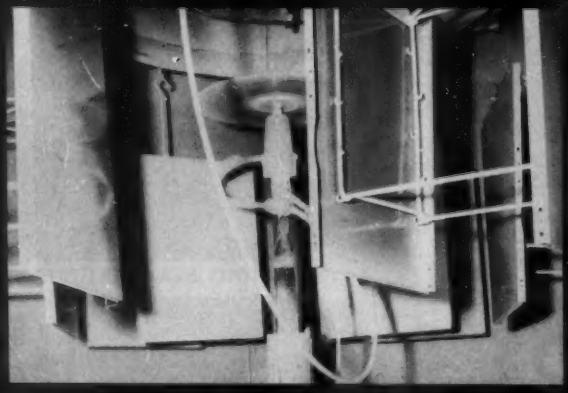
KELVINATOR
Washers and Dryers

Get their High Quality Finish with



RANSBURG NO. 2 PROCESS

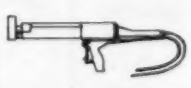
Kelvinator Division of American Motors switched from hand spray to RANSBURG No. 2 PROCESS Electro-Spray to meet increased production schedules . . . improve the quality of the finish . . . and lower finishing costs.

SAVINGS EXCEEDED EXPECTATIONS

Demonstration tests in the Ransburg labs indicated substantial savings in finishing costs, but in actual production, SAVINGS ARE EVEN GREATER than estimated. That's why Kelvinator is now considering RANSBURG Electrostatic Spray Painting for other products of their "white goods" line: Refrigerators . . . Home Freezers . . . Ice Cream Cabinets . . . Electric Ranges, as well as some components.

NO REASON WHY YOU CAN'T DO IT, TOO!

Want to know how Ransburg No. 2 Process can improve the quality of YOUR painted products, and at the same time, cut YOUR paint and labor costs? Write for our No. 2 Process brochure. Or, if your production doesn't justify automatic painting, let us tell you about the new No. 2 Process Electrostatic Hand Gun which can be used in either conveyorized, or non-conveyorized painting.



RANSBURG

RANSBURG
Electro-Coating Corp.
Box-23122, Indianapolis 23, Indiana

Circle No. 55 on Reader Service Card

NEW PRODUCTS

continued from page 12

REMOVES ALUMINUM OXIDE

CHEMCLEAN PRODUCTS — Ox-Off #536 removes oxide, scale and heat discoloration from aluminum in one step. It is used to clear aluminum before welding, to remove discoloration after welding, soldering or heat treatment, and to level off minor scratches.

Circle No. 238 on Reader Service Card

BRIGHT NICKEL COATING

HANSON-VAN WINKLE-MUNNING CO. — Superlume a new process for producing a bright, smooth nickel coating has been developed. The process is said to yield deposits which are exceptionally bright at high and low current density areas, and it has the ability to level-out scratches. It is also characterized by excellent tolerance to inorganic impurities such as zinc and copper.

Circle No. 239 on Reader Service Card

ABRASIVE BELT GRINDER

HAMMOND MACHINERY BUILDERS— Model VHP-6 is a manual or semi-automatic 6" platen grinder with a semi-automatic oscillating-tilting table. The unit features a water-cooled-and-lubricated platen which reduces friction and temperature. Platen face styles available are chrome-faced for manual grinding and carbide-faced for semi-automatic grinding. Platens are reversible top to bottom for longer life.

Circle No. 240 on Reader Service Card

FIXTURE DEBURRING

MECHA-FINISHED CORP. — Mechamatic MM-2 High Speed Model No. 3000, is a two spindle unit for fixtured deburring and finishing of a multiplicity of parts, (low production), or of a single component, (high production). The main feature of the unit is two independently operated spindle heads which allow the operator to service one spindle while the other is in process. The unit illustrated at a 15-second time cycle, will produce 240 pieces per hour at 100% efficiency and has capacity up to 6" diameter piece part.

Circle No. 241 on Reader Service Card

4″ HIGH VACUUM EVAPORATOR

VEECO VACUUM CORP. — The VE-400 is a new modular high vacuum evaporator that features stainless steel construction, fast pumpdown, and low ultimate pressure. This system permits the purchase of a high vacuum system, or evaporator that is suited to current needs, and permits additional equipment to be incorporated as required.

Circle No. 242 on Reader Service Card

TEMPERATURE INDICATORS

MARKAL CO. — Thermomelt is a precision temperature indicator available in stick, pellet and liquid form, that will indicate when a specific temperature in the range from 113° to 2000° F. is reached. A mark is placed on the surface and when the temperature wanted is reached, the mark quickly liquefies.

Circle No. 243 on Reader Service Card

AUTOMATIC WASHER

CONFORMING MATRIX CORP. — An automatic high pressure mask washing machine for handling masks up to 72″ long, 18″ wide and 16″ deep has been announced. The unit is said to permit a time and labor saving of up to 50% over that of manual cleaning. Up to 20 coats of wet paint can be removed by the unit in 20 seconds.

Circle No. 244 on Reader Service Card

TAPPING ATTACHMENT

TAPMATIC CORP.—Tapmatic 500A, is an adjustable torque high production tapping attachment that meets torque and speed requirements for fluteless taps as well as standard taps. Maximum speed is 2000 rpm. and at this speed unit reverses at 3000 rpm. The unit is said to be ideal for high production or automated set-ups.

Circle No. 245 on Reader Service Card

VACUUM MELT STEELS

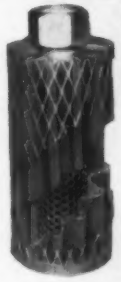
VANADIUM-ALLOYS STEEL CO. — Vacuum melted steels and high speed steels on display at the Metal Show include a large ingot of a consumable vacuum melted steel and a smaller ingot, cut in half and ground, lapped and polished to show the metallurgical quality of vacuum melting.

Circle No. 246 on Reader Service Card

MARVEL
SYNCLINAL FILTERS

FOR DEPENDABLE PROTECTION on all Hydraulic and other low pressure circulating systems

Designed to give more ACTIVE filtering area—MORE dependable protection—MORE productive operation before cleaning is necessary. *Meet J.I.C. Standards.*



Synclinal SUMP TYPE

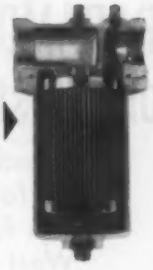
CAPACITIES: 5—8—10—20—30—50—75 and 100 G.P.M.
PIPE SIZES: ¾″—1″—1¼″—1½″—2″—2½″ and 3″.
CONNECTIONS: Coupling—Male Nipple.
BY-PASS VALVE: Not Available.

Synclinal LINE TYPE

CAPACITIES: 5—8—10—20—30—50—75 and 100 G.P.M.
PIPE SIZES: ¾″—1″—1¼″—1½″—2″—2½″ and 3″.
BY-PASS VALVE: Not available.
OPERATING PRESSURES: Up to 80 p.s.i.

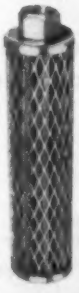
Bonded SUMP TYPE

CAPACITIES: 10—20—30—50 and 75 G.P.M.
PIPE SIZES: 1″—1¼″—1½″—2″—and 2½″.
CONNECTIONS: Coupling—"O" Ring—Male Nipple.
BY-PASS VALVE: Available with or without



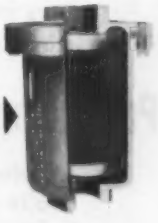
Bonded LINE TYPE

CAPACITIES: 10—20—30—50 and 75 G.P.M.
PIPE SIZES: 1″—1¼″—1½″—2″ and 2½″.
BY-PASS VALVE: Available with or without.
OPERATING PRESSURE: Up to 250 p.s.i.
OPERATING TEMPERATURES up to 300° F.



Tandem SUMP TYPE

CAPACITIES: 10—16—20—40—60—100—150 and 200 G.P.M.
PIPE SIZES: ¾″—1″—1¼″—1½″—2″—2½″ and 3″.
CONNECTIONS: Coupling—Male Nipple.
BY-PASS VALVE: Not available.



IN-LINE FILTER

CAPACITIES: Up to 60 G.P.M.
PIPE SIZES: ¾″—1″—1½″ and 1½″ (at both inlet and outlet).
BY-PASS VALVE: Available with or without

FILTERING MEDIA in all Marvel Filters is Monel wire cloth available in mesh sizes of 30-40-50-60-80-100-150 and 200 to meet your filtration requirement.
EASY TO CLEAN—All Marvel Filters are easy to clean. Line type units operate in any position and may be serviced without disturbing pipe connections.
OVER 900 O. E. M's. install Marvel Filters as Standard Equipment.

IMMEDIATE DELIVERY

For further information on a specific type filter—Write—wire or phone

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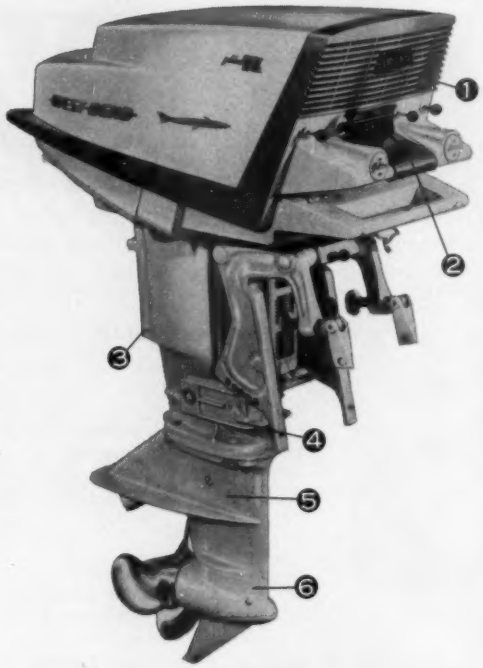
(PMM-5)

Please send me information on Marvel Filters as indicated:

☐ Hydraulic Oils ☐ Coolants ☐ Lubricants ☐ Fire Resistant Fluids
☐ Water ☐ Sump Type ☐ Line Type ☐ In-Line

Name_____
Company_____
Address_____
City_____ State_____

PARAMOUNT
Die Castings
AT WORK
No. 3 of a Series.



❶ Engine Grille Panel
❷ Carburetor Access Door
❸ Motor Leg Exhaust Cover
❹ Lower Shock Mount Cover
❺ Upper Gear Housing
❻ Lower Gear Housing

PARAMOUNT Die Castings Important on West Bend Outboard Motors

Economy, accuracy, strength and appearance were the factors in the wise choice of aluminum die castings for this sleek 40 H.P. Golden Shark Model by West Bend Aluminum Company.

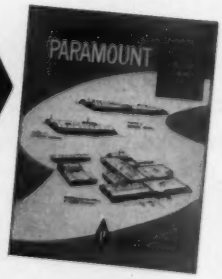
Engineering and production "know-how" were factors in the selection of Paramount to produce these die castings.

Paramount Can Help You, Too . . .

Whatever your product, if there's a die casting in it, or if you're considering re-design for die castings, it will pay you to investigate the complete die casting services available at Paramount Die Casting Co.

Three complete plants—
two in St. Joseph, Michigan
one in Seymour, Indiana

SEND FOR THIS HELPFUL BROCHURE and "Designing for Die Casting".



RESEARCH PARTICIPANT

PARAMOUNT *Die Casting Co.*
(A subsidiary of TALON, INC.)
ST. JOSEPH, MICHIGAN

Circle No. 43 on Reader Service Card

INDUSTRY NEWS *(continued)*

NEW METALLURGICAL DIV. AT P. R. MALLORY

P. R. Mallory Co., Indianapolis, Ind., has combined two of its manufacturing divisions and three subsidiaries to form a metallurgical and mechanical group.

The new group is made up of Mallory Metallurgical Co., Electronic Timers Co., Philadelphia Bronze & Brass Corp., S-M-S Corp., and Indar Corp. Leon Linn, former president and general manager of Mallory Metallurgical Co., has been appointed general manager of the new metallurgical and mechanical group.

HUFFMAN MANAGER OF EXTRUSION PLANT

Clifton J. Huffman has been appointed manager of the aluminum extrusion plant of Almetco, Inc., at Nesquehoning, Pa., it was announced by H. E. Gude, president of Almetco, Inc., and vice president - manufacturing, Metals Division, Olin Mathieson Chemical Corporation. Almetco is a wholly-owned subsidiary of Olin.

JANNEY CYLINDER CO. EXPANDS INTO EXTRUSION FIELD

Janney Cylinder Co. of Philadelphia, Pa. is now producing a wide variety of extruded metal shapes. While current production is mainly of copper-base alloys in various sizes ranging from 1" to 8" in diameter, in 10' lengths, production facilities also permit secondary and hot and cold forming operations . . . producing a variety and range of shapes not obtainable by conventional extrusion processes.

Expansion into the quality extrusion field adds to the company's versatility of operations, which includes centrifugal casting as well

as specialty processing. Modern equipment and facilities insure quality control over billet stock from spectographically controlled melts. Extrusions produced under such control feature high reduction ratios for greater uniformity, and excellent grain refinement, and close dimensional tolerance.

RANSOM & RANDOLPH NAMES MANAGER-INDUSTRIAL PRODUCTS

SCHWARTZ

Ransom & Randolph Co., Toledo, Ohio, has appointed Carl H. Schwartz as manager of the industrial products division. The announcement of the appointment came from E. A. Kline, vice president of the company. The industrial products division handles manufacturing and sales of investment materials for precision casting in non-dental fields; these include the jewelry, non-ferrous metals and alloys, and ferrous metals and alloys fields.

The company has been a supplier of these investment materials for 88 years.

ROTO-FINISH APPOINTS STEVENS

G. W. Balz, President, Roto-Finish Company, Kalamazoo, has announced the appointment of Jack A. Stevens as Eastern Division Sales Manager. He will supervise and coordinate all sales activity in New England, the Eastern states, and part of the Midwest.

Stevens joined the company in 1957, and for the past 2¼ years has been sales representative in the Dayton area.

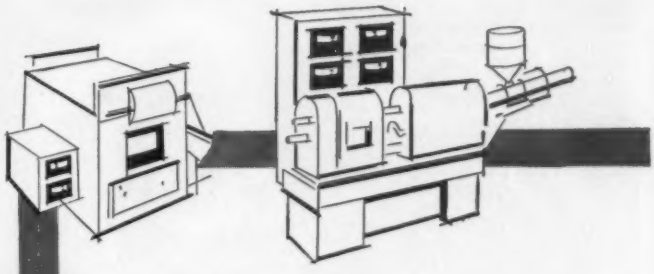
More news on page 84

Why it pays to see that

WEST Instruments are in

Original Equipment

using Temperature Control



Makers say

"Our equipment sells best on performance, including ease of operation and maintenance. We can't risk dissatisfaction that stems from components, such as instruments. We're safer with Gardsman, by West, and their world-wide service."

Users say

"Instrumentation can be the key to overall efficiency of major equipment. West temperature controllers work better than most, definitely save on several counts . . . including initial cost. It pays to specify."

Whatever type of control—off-on, proportioning, high-limit, stepless, program—get the best: get West. *Tubeless.* Compact. Reliable. Ask your West representative or write for Bulletin COM.

See us at the ISA Instrument-Automation Conference & Exhibit San Francisco, Calif. Brooks Hall May 10-12, 1960 Booth 419-421

WEST Instrument CORPORATION

SALES OFFICES IN PRINCIPAL CITIES

4357B W. MONTROSE, CHICAGO 41, ILL.

British Subsidiary: WEST INSTRUMENT LTD., 52 Regent St., Brighton 1, Sussex

Represented in Canada by Davis Automatic Controls, Ltd

the trend is to WEST

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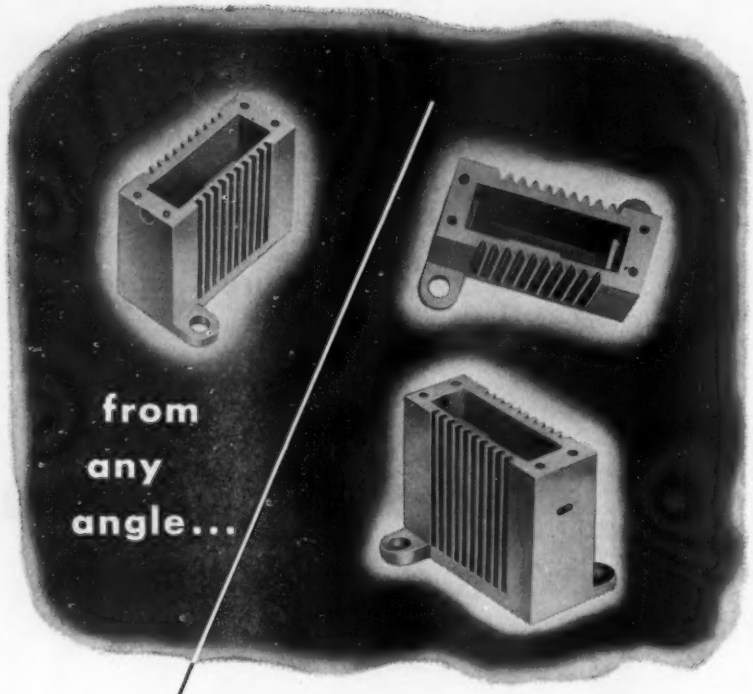

it still calls for DIE CASTING

Only die casting could hold the design, achieve production and maintain the exactness of this complex part.

Another method might approach die casting in one category but fail in another.

Take tolerances like these: Four holes drilled and tapped for #0-80 threads and held to a relation of ± .002. Slot, .042 x .125, machined through 3/16" wall. Two holes (one .159 and blind, the other .093) held to ± .001 and in line.

That's die casting as they know it at Twin City Die Casting . . . a respect for design tuned to production, a reputation for exactness. With any question on die casting, call, wire or write.

...only DIE CASTING can

✓ cut your costs ✓ offer such flexibility

✓ provide such accuracy

Leading Die Casters in the Upper Midwest

TWIN CITY DIE CASTINGS CO.

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RESEARCH PARTICIPANT

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NEW COMPANY IN INDUCTION MELTING FIELD

HOFF COLEY

Formation of a new company, Inductotherm Linemelt Corp., has been announced. The newcomer will manufacture core-type and coreless low-frequency induction melting equipment.

J. Lloyd Hoff is president of the company and Alfred A. Coley is vice president. Both men have long experience with low-frequency induction melting.

The new company also has an agreement to handle the Swiss made Brown Boveri coreless low-frequency melting furnaces.

Headquarters of the company is at 412 Illinois Ave., Delanco, N.J. Inductotherm Linement Corp., is associated with the Inductotherm Corp., manufacturers of medium-frequency induction heating and melting equipment.

ALUMINUM EXTRUSIONS, INC., APPOINTS NEW ENGINEERING, CREDIT MANAGERS

Aluminum Extrusions, Inc., of Charlotte, Mich., has appointed new engineering and credit managers.

W. E. Dunlap, AE president, said that Robert M. Caldwell would serve as manager of engineering and Thomas W. Welch would serve as credit manager.

Mr. Caldwell will be responsible for all phases of engineering, including processing, work standards, tooling, and plant maintenance. Most recently he was plant manager of the Jervis Corporation, Grandville, Mich.

Mr. Welch will be responsible for administering the credit policies and systems of AE and its affiliated product company, Structural Products, Inc., also of Charlotte. He had been a credit analyst with the National Bank of Detroit.

APPOINT DEPUTY DIRECTOR OF STEVENS POWDER METALLURGY LABORATORY

Jack A. Yoblin, senior engineer with the General Electric Company, has been appointed Deputy Director of the Stevens Institute of Technology Powder Metallurgy Laboratory, it was announced by Vice Admiral Howard E. Orem, director of research.

In this newly created position, Mr. Yoblin will assist Professor Gregory Comstock, who heads the Stevens facility, in technical and administrative direction of the Laboratory's research program. Established in 1938, the Powder Metallurgy Laboratory was the first of its kind on an American college campus.

TWO MORE COMPANIES JOIN THE INVESTMENT CASTING INSTITUTE

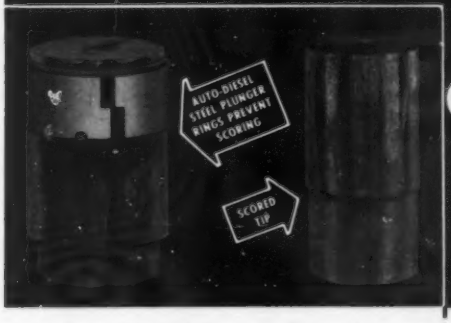
The Engineering Division of the Chrysler Corporation has joined the ICI as an allied member. This new category of membership was recently made available to manufacturers who use investment castings in their products, and are interested in participating in the many technical programs of the ICI. R. D. Chapman, assistant chief engineer of Chrysler's Engineering Division, will be the official representative to the ICI.

J. H. Morison, president of the ICI also reports that Intricast, Inc., has recently become a regular member of the Institute. W. F. Krahl, President of Intricast will be the official representative.

NEW BRITISH PRESS TO BE SHOWN

The powdered metal industry will be interested in the new 200 ton multi-purpose compacting press which will be announced at the British Exhibition USA to be held in the New York Coliseum, June 10th through 26th. This exhibition is coincidental with the International Powder Metal Conference, sponsored by the Metal Powder Industries Federation, at the Biltmore Hotel, June 13th through 17th.

NEW TIP & RING PLUNGER COMBINATION



6 MONEY SAVING ADVANTAGES

1. Longer wear
2. Denser castings
3. Eliminates aluminum pick-up on sleeves
4. Reduces tip changing down-time
5. Eliminates buying or making new tips
6. You can salvage and use your old tips

Greater Efficiency

Solves problem of scored or worn tips—saving thousands of dollars per year for the die casting industry.

Beryllium copper and steel plunger rings on piston tips result in maximum service life.

Catalog on Request

Plus—Auto-Diesel now offers stainless steel liners for goosenecks—increasing present life 4 to 1—literature on request.

THE AUTO-DIESEL PISTON RING CO.
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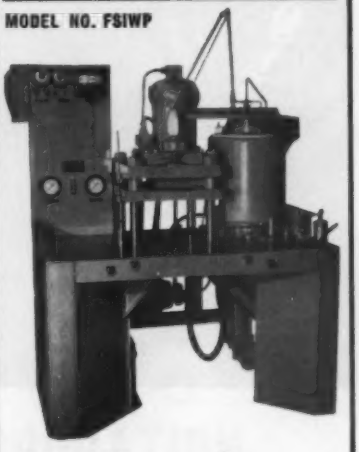
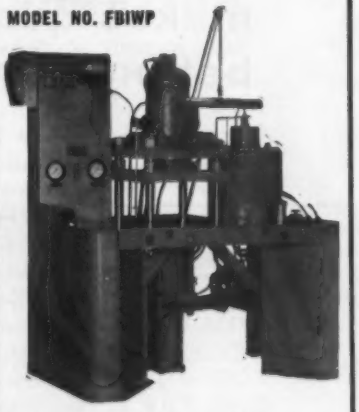
NEW
3½ lbs. WAX CAPACITY
ON STANDARD MODEL
#FSIWP

MODEL NO. FSIWP



MODEL NO. FBIWP



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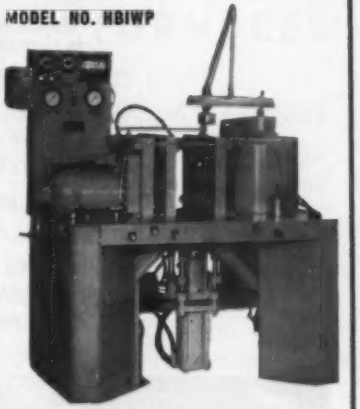

For complete details write direct to Leyden Hydraulics

Any Type or Size Unit Built to Your Specifications.

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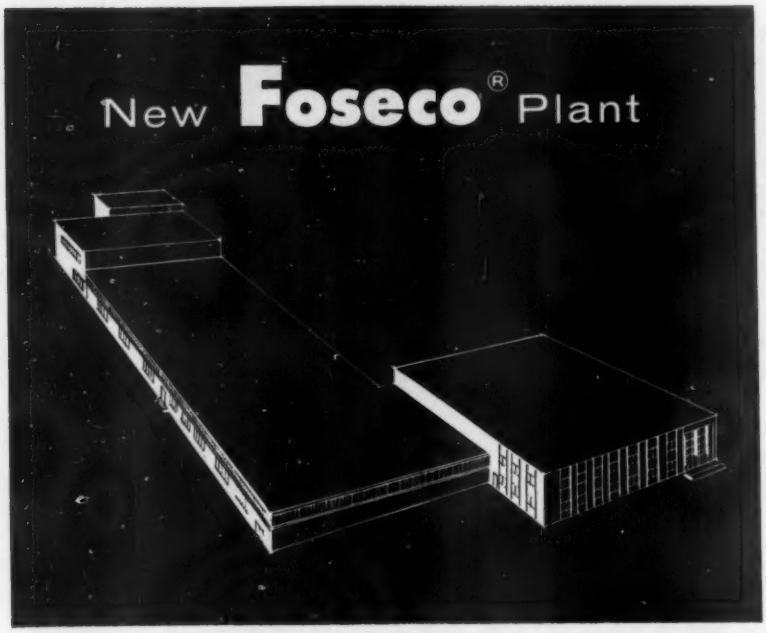

makes quality and service better-than-ever

■ Now located near the heart of the nation's expanding foundry industry, Foundry Services, Inc. looks forward to closer customer relations in the best Foseco tradition. A new experimental foundry, well-equipped laboratory and spacious production plant provide up-to-the minute facilities for the manufacture of Foseco products. Here, an expanded research and development section will develop significant new products, discover new methods to overcome casting defects and improve foundry operations. Foseco's growth is dynamic proof of Foseco quality—recognized the world over.

Visit our booth at the American Foundrymen's Society Convention, Philadelphia
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A world-wide organization serving the chemical and metallurgical needs of the entire metal casting industry.

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Foundry Services, Inc.
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THE NEWTON-NEW HAVEN CO. NAMES STEVENSON AS TECH. REPRESENTATIVE

The appointment of James F. Stevenson as technical representative for the Newton-New Haven Company, die casters in West Haven, Connecticut, has been announced by Harry Bollman, sales manager. As technical representative, Mr. Stevenson will contact Newton-New Haven customers advising them on their die casting design and production problems.

For the past 25 years, the Newton-New Haven Company has been utilizing its design experience and die casting craftsmanship in assisting manufacturers to produce an improved product offering better appearance, reduced assembly time and superior finish.

MacDERMID TO BUILD NEW RESEARCH LABS.

Construction will begin immediately on a new research and development laboratory for MacDermid Incorporated, Waterbury, Connecticut manufacturer of metal cleaning, plating and finishing chemicals. The new two-story addition to MacDermid's existing research and manufacturing facilities will have about 7,000 square feet of floor space. The new laboratory will provide space for research in chromate conversion coatings, copper plating process, cleaners, and other metal finishing compounds.

EMPLOYEES' SERVICE HONORED AT BUNTING

Skilled craftsmanship achieved through years of continuous service will be honored by the Bunting Brass & Bronze Company, Toledo, Ohio, at the company's first annual service award banquet.

Guests at the banquet will be Toledo employees who have compiled a record of 25 or more years of continuous service. This group represents about a quarter of Bunting's total employment. Among all employees at Bunting, about 90 percent can boast of having 10 or more years of service.

William M. Hankins, Jr., president of Bunting, will make the award presentations and deliver the principal address.

REYNOLDS CONTAINER PILOT PLANT

A pilot plant for development of new types of aluminum containers will be built by Reynolds Metals Company at Bellwood, Va., William G. Reynolds, executive vice president for research, announced.

To be known as the Container Development Plant, the 20,000-square-foot building will house production tests on experimental aluminum cans and semi-rigid containers.

Cost of the container development plant, including land, building and equipment, may exceed $700,000.

The plant will be part of Reynolds new centralized Packaging Research Division, formation of which was announced by Mr. Reynolds on December 11. A. Irving Totten, Jr., is general director of the division. Its other units, all located in Richmond, include foil packaging research laboratory, pilot printing plant and machinery development section.

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SELLERS OF

'METALKAT'
BRAND ELECTROLYTIC ZINC

SPECIAL HIGH GRADE 99.995% +
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BEST
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UPSETTING
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PRODUCES MORE AND BETTER PIECES BETWEEN DIE CHANGES.

A graphited product for use in working hot metals of all kinds. Good in temperatures up to 2200° F and above. Keeps work cool and extends the life of dies and punches. Highly adhesive, may be applied by brush or swab or diluted with oil for spraying.

Bulletins describing Fiske's 514A Hot Die Lubricant and other specialty lubricants and coolants sent on request.

FISKE BROTHERS REFINING 90th Anniversary NEWARK, N.J.-TOLEDO, O.

FISKE'S

FISKE'S METAL WORKING LUBRICANTS

FISKE BROTHERS REFINING CO.
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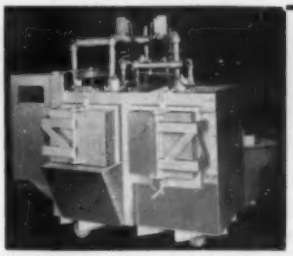

New!
KOZMA
RADIANT ALUMINUM BREAKDOWN AND HOLDING FURNACES

UNEQUALLED FOR LOW POROSITY ALUMINUM CASTINGS

Exclusive Kozma "Pre-Temp" charging and subsurface metal flow practically eliminates oxygen and hydrogen pick-up and oxide inclusions, keeping metal at high purity level.

Radiant firing provides faster, more uniform heat distribution, eliminates flame impingement and reduces fuel costs.

Kozma Model RSHCH Furnaces range in capacity from 300 to 2,000 lbs. per hour with design variations to meet your requirements. Write today for details on this new furnace.

Also new from Kozma — Automatic Ladling Unit

Low Cost
Fast
Accurate

J.A. KOZMA Company
2471 WYOMING
DEARBORN MICHIGAN

Industrial Processing Furnaces Since 1928

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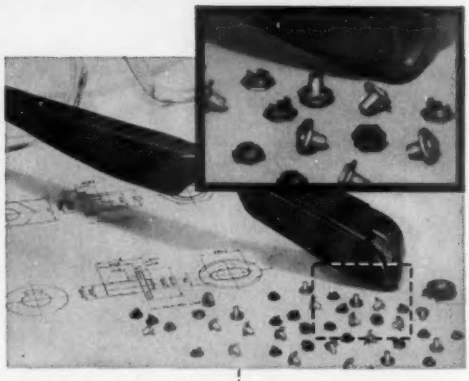
HEARING AID MAKER

gets sound savings with tiny GRC mating parts

die cast in zinc alloy for Centralab miniature volume control



Custom precision with production economy: the combination Centralab needed—and found—with GRC's design experience and exclusive single cavity die casting techniques. These uniform, complex mating parts, with overall tight tolerances (some to ± 0.0005") are another example of the way GRC has opened new approaches to product design . . . how GRC can help solve your tiny parts problems . . . at substantial savings.

Quick deliveries on quantities of 100,000 to many millions.

See us at the DESIGN ENG. SHOW—Booth 2435

Write for detailed bulletin or send prints for quotation.

NO SIZE TOO SMALL!
Max. weight ½ oz.
Max. length 1¾"

25 years of progress in tiny parts

GRIES REPRODUCER CORP.
World's Foremost Producer of Small Die Castings
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GRIES GRC

STOKES ADDS TO ITS NEW ENGLAND SALES REPRESENTATION

The rapidly broadening line of Stokes equipment for the economical production of pharmaceuticals, molded plastics, and powder metal products, and the growing demand for this equipment in the New England region, have led F. J. Stokes Corporation, Philadelphia, to expand its sales representation in the New England territory in a planned program of strengthening its technical services to industry.

David G. Cameron, who has had extensive experience in the field of tabletting and industrial compacting, has been appointed an additional sales engineer for the company's Press Division in the New England territory. Working out of the Stokes district office in Portland, Connecticut, under the direction of Harold G. Roman, district manager, Mr. Cameron will be serving Stokes' customers throughout all the New England states.

A WINNING COMBINATION for your DIE CASTINGS

EXPERIENCE —
is the first prerequisite for quality die castings. Our staff of expert designers, engineers and production men have the know how and experience of over 31 years in the industry to save you money while turning out top quality castings.

GUARANTEED QUALITY —
As a licensed producer of die castings under the Certified Zinc Alloy Plan, you can be sure that your zinc castings conform to the strict chemical composition limits for maximum mechanical and physical properties.

PROGRESS —
Our participation in the Die Casting Research Foundation is our way of contributing to the future development of the die casting process and its usefulness as a metal working method.

For quality, service and cost, the above symbols are your guide to the best in die casting in the Midwest.

BADGER Die Casting Corp.
201 W. Oklahoma Avenue
Milwaukee 7, Wisconsin

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COLUMBIA TOOL STEELS

ATMODIE SMOOTHCUT (D2S) free machining high chrome air hardening die steel gives a real "run for the money."

Product of Skilled American Workmen

ZINC DIE-CAST MASKS

RCA Flight Line Series portable TV sets are strong, rigid and light. One good reason for these characteristics, the bezel and screen masks are made by die casting them in zinc. The assembled TV set has a fine finish.

Why not use aluminum instead of zinc? Both had been considered. Zinc was chosen for its many advantages explained to the customer by the New Jersey Zinc Company.

Although aluminum is a lighter metal when similar quantities of metals are used, the zinc could be die cast in thinner sections. Final product weighed less than a pound; almost the same weight as aluminum.

The weight was only one factor. Strength and rigidity of zinc made other economies possible.

Strength in the screen mask meant that the set's housing could be made thinner.

The rigid mask meant elimination of strengthening frames.

The mask could be manufactured cheaper, dies cost less.

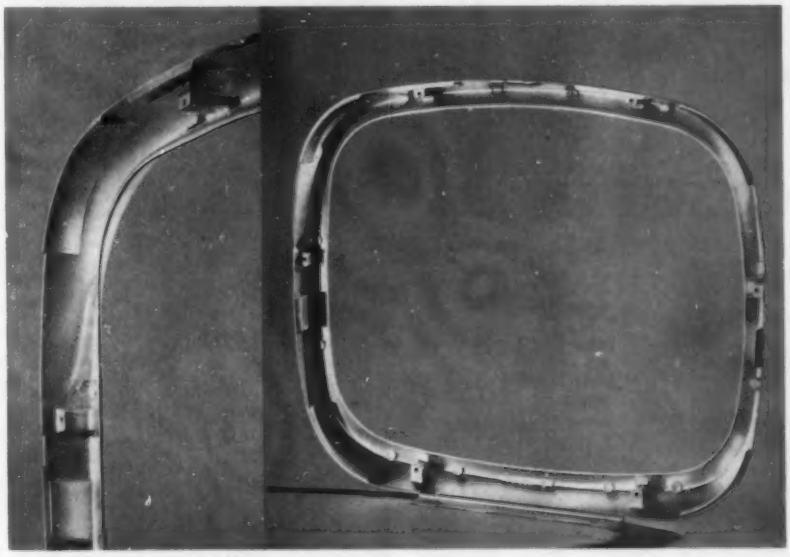
Surface finish required little attention to give the product a modern look, cut manufacturer's costs.

And overall weight was cut, as well as service life lengthened.

MECHANICAL STRENGTH OF ZINC AND ALUMINUM

Alloy	*Tensil Strength psi*	*Elongation in 2 inch per cent*	*Brinol Hardness*
Zinc	41,000	10.0	82
Aluminum	33,000	9.0	*

**Hardness tests are considered too unreliable on aluminum die castings. (Data from ASTM 1958)*

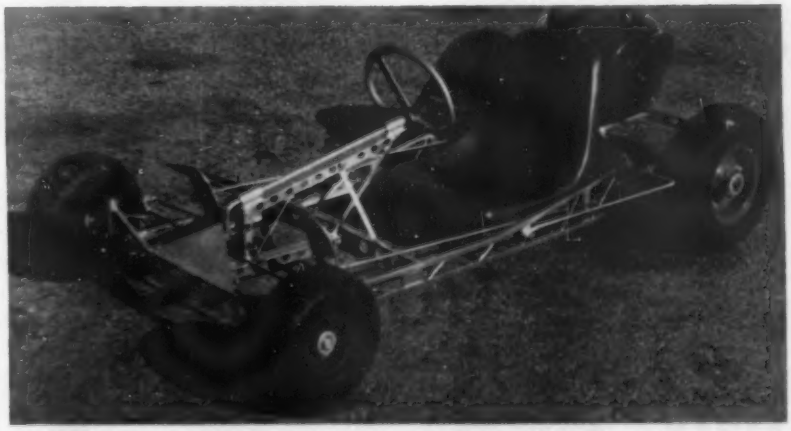


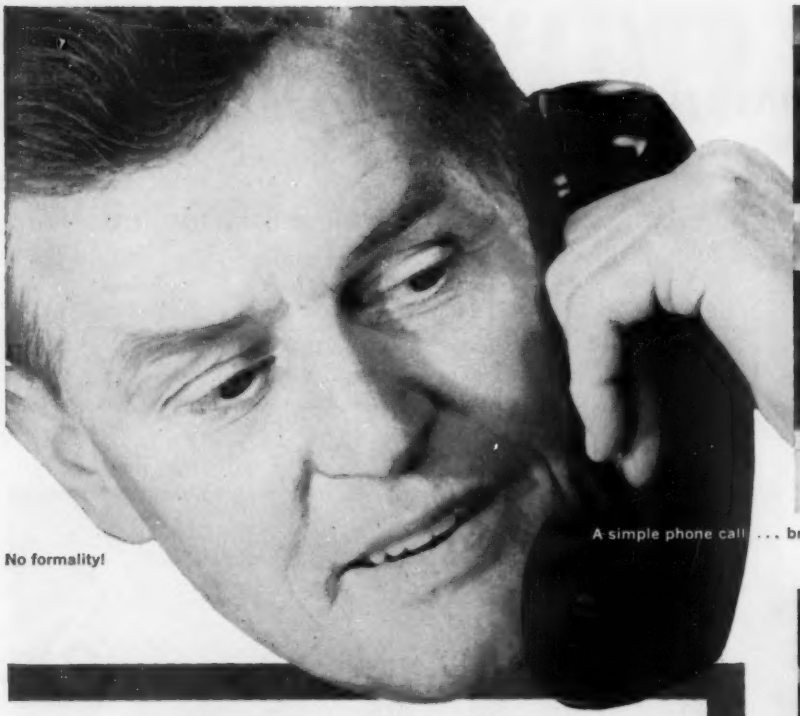
IF WHEEL BEARINGS COULD TALK!

If the oil wheel bearings used in this Acorn Tool & Manufacturing, Inc. small car could talk, they'd be sounding off about the wonders of production; powder selection, heat and pressure treatment, and final machining. The bronze sleeve bearings are placed in critical locations, designed to give the driver-operator an economy car; smooth, quiet operation; and lasting quality.

Grit and dirt from off-the-road operation are the bearings greatest detriments.

After a 10,000 mile run at dusty Daytona Beach, Florida, a similar car to that in the photograph was disassembled. Its bearings showed "No discernible wear," and for all the wear-and-tear received, the bearings would be expected to be expensive. They are comparatively low in cost, another tribute to powder metallurgy.





No formality!

A simple phone call . . . brings a Resident Doehler-Jarvis Sales Engineer.

and/or sub-assembling the finished parts . . .

How to contact your Doehler-Jarvis Resident Engineer

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HIllcrest 4-4819

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(Missile & Electronic
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GArden 4-8169, GArden 5-9019

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(Missile & Electronic
Systems Components, Inc.)
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P.O. Box 828
JUniper 4-1171

St. Louis, Missouri
Custom Industrials Company
128 North Gay Avenue
Clayton 24, Missouri
PArkview 6-2110

Phoenix, Arizona
McDonald Industrial Sales, Inc.
3300 N. Central Ave., Room 222
AMherst 5-1950

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Norwest Company
210 North 136th Street
MElrose 3-3232

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Doehler-Jarvis

Division of **NATIONAL LEAD COMPANY** General Offices: Toledo 1, Ohio.
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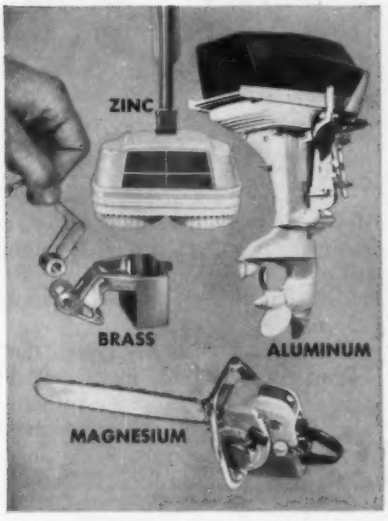
Never has as satisfactory

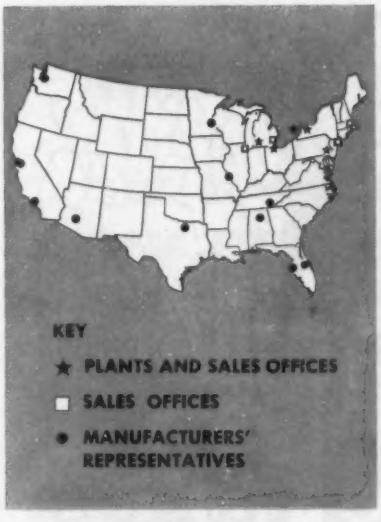
As the pictures above imply . . . Doehler-Jarvis makes the buying of die castings a simple matter today.

First, you deal with a Doehler-Jarvis Resident Engineer. Through him you can tap the full production and engineering talent of the most experienced company in die casting . . . no matter how large or small your requirements. Through him you obtain personal day to day liaison that insures maximum production economy through personal attention to your needs and problems.

You get immediate help in engineering the design . . . and evaluating the economics of die casting . . . plating or otherwise finishing . . .



using the most appropriate die casting alloys.



Large, fully-equipped Doehler-Jarvis plants . . .

assure economical production, reliable delivery.

the buying of die castings been as simple or as Doehler-Jarvis makes it today!

Second, in addition to the castings themselves, Doehler-Jarvis provides added resources you may need: ample alloy stocks; fully equipped die making shops; complete facilities for light metal working, including machining, finishing and sub-assembly lines; spacious die and parts storage; a huge tractor-trailer fleet to *assure* delivery.

Thirdly, you can be sure that Doehler-Jarvis has in its eight plants, the productive capacity to meet your schedules no matter how large . . . and a flexible organization to give them proper attention no matter how small.

Small wonder that many companies, large and small, look upon Doehler-Jarvis almost as a department of their own plant. That's true of makers of hand power tools, of floor waxers, of sprinklers and garden hose fittings, of chain saws, of typewriters, of kitchen and other appliances, of hundreds of other products.

Doehler-Jarvis has served many companies for more than a quarter century, some for better than 50 years. Proof enough that no other die caster provides more quality, more service and more overall economy to the customer. Ask your Doehler-Jarvis Resident Engineer to tell you how much we are prepared to do to establish equally satisfactory supplier-purchaser relations with you.

Doehler-Jarvis

Division of
NATIONAL LEAD COMPANY

Circle No. 97 on Reader Service Card

ELECTROLUX INCREASES FURNACE CAPACITY

Electrolux Corporation recently installed two Lindberg 80 KW two-chamber melt and hold induction furnaces for aluminum die-casting vacuum cleaner parts. The cleanliness and ideal working conditions of the Electrolux Plant were maintained with the absence of noise and burner heat in the new installation. In addition, unique furnace hoods remove accumulated gases.

NEW MPIF MEMBERS

The Metal Powder Industries Federation has announced the election of the British Metal Sinterings Association and the Japan Powder Metallurgy Parts Manufacturers Association as "Overseas Cooperating Associations" thus officially linking these organizations in an international program of cooperation in powder metallurgy.

The British and Japanese organizations are trade associations for contract powder metallurgy parts manufacturers. As members of the Federation, it will now be possible to develop a program of technical exchange and closer cooperation in standardization activities.

The British Metal Sinterings Association is located in Birmingham, England and is represented in the Federation by Peat, Marwick, Mitchell & Co.

The Japan Powder Metallurgy Parts Manufacturers Association is located in Tokyo, Japan and is represented in the Federation by Jujiro Miyauchi.

APPOINTMENTS AT U.S. REDUCTION CO.

NEUFELD

SOLOMON

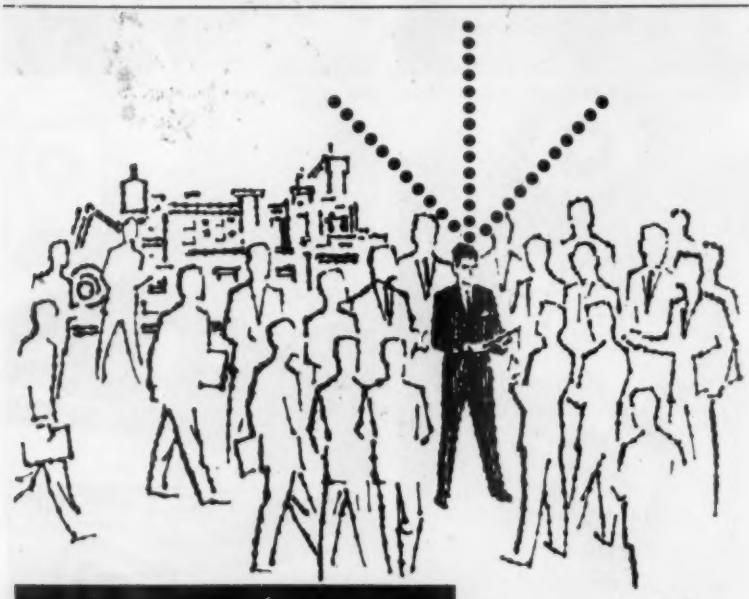
Edwin A. Bergman, president of U.S. Reduction Co., announced today the election of Jerry I. Solomon as vice president in charge of purchasing, and Richard S. Neufeld as vice president in charge of sales.

Mr. Solomon has been with the company since 1952, serving as a scrap buyer in various southern and midwest territories before being promoted to director of purchases, the position he held before his current promotion.

Mr. Neufeld started with U.S. Reduction Co. in 1948 in the Chicago sales territory, and served subsequently as assistant sales manager and sales manager prior to this promotion. He has been an active member in the American Foundrymens Society and Society of Die Casting Engineers for many years.

DIMAN DIV. MGR. AT C. I. HAYES

William C. Diman, long-time employee of C. I. Hayes, Inc., has been appointed manager of the furnace division of this Cranston, R.I. firm. Mr. Diman came with Hayes in 1946 after serving as Squadron Commander in the 9th Air Force in World War II. In his



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various capacities with Hayes as service engineer and furnace application engineer, he has originated many advanced furnace designs which have influenced heat treating techniques, particularly in the electronics and ceramics industries. In his new assignment, he will have responsibility for selling and quoting functions . . . will assist on engineering . . . and will act as liaison between research and production on the broad line of Hayes electric furnaces.

YOUNG JOINS RANSOHOFF

William H. Young has recently joined the sales staff of the Ransohoff Company of Hamilton, Ohio, manufacturers of equipment for metal surface processing. The appointment was announced by R. C. Wigger, Ransohoff vice-president.

DeVILBISS APPOINTMENT

BOHON

The appointment of D. L. Bohon as manager of industrial sales for The DeVilbiss Company has been announced by H. M. Kidd, vice president-sales.

E. F. Frey, who has been manager of industrial sales, will continue to serve as sales liaison officer between the industrial and jobber sales divisions and take on the additional duties of correlating sales efforts on DeVilbiss Metal Fabricators' products. The latter are manufactured by a subsidiary company, engaged in the custom manufacture of ovens, spray booths, dip coaters, flow coaters, spray and dip washers, dust collectors, air replacement and other components of finishing systems, and is headquartered in Detroit.

NEW V.P. AT WELLMAN BRONZE

D. T. Wellman, president of the Wellman Bronze and Aluminum Company, manufacturers of aluminum and magnesium castings, announced the appointment of Dr. Fred J. Dunkerley as vice-president in charge of production for all plants.

Dr. Dunkerley brings to Wellman more than 18 years professional experience including 5 years in industrial metallurgical research at Battelle Memorial Institute, Columbus, Ohio; 5 years in metal research as professor of metallurgy at the University of Pennsylvania; and 5 years in foundry technology and management with one of the largest magnesium and aluminum foundries in the eastern United States.

He took his undergraduate and graduate schooling at the Carnegie Institute of Technology where he received a doctorate in science.

RADIOGRAPHS

FOR LIGHT METAL CASTINGS - EL55

The aircraft and missile industry has a new tool for maintaining quality of aluminum and magnesium castings. Tentative Reference Radiographs for Inspection of Aluminum and Magnesium Castings Series II E 155 provides 13 radiographs covering discontinuities in aluminum alloy castings and 12 for magnesium alloy castings. Each radiograph illustrates eight

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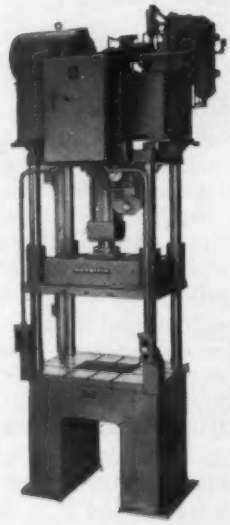

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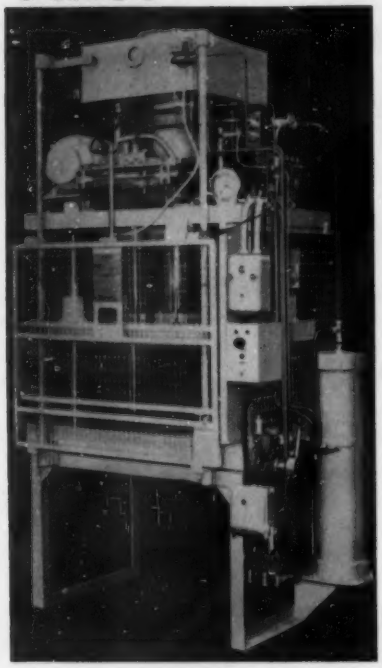

A brand new 34-ton clipping press from BIPEL... world renowned for their plastic molding presses! This special purpose hydraulic unit offers a faster approach (600 ins./min.), and a fast advance through the work (40 ins./min.), at full tonnage. Dry Cycle Time only 3 seconds. Semi-automatic or manual control... with mesh guards for maximum operator safety. A flexible, efficient, clean-trimming unit.

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grades of severity for a particular discontinuity.

These standards developed through the cooperation of the Quality Control Committee and the Aerospace Research and Testing Committee of the Aerospace Industries Association are actual radiographs, rather than photographic reproductions. This has been done to provide industry with well defined radiographs which are easy to interpret. While of tremendous interest to the aircraft industry in particular, other segments of industry and government concerned with these light metal castings will find them of value as references against which quality control radiographs can be checked.

The radiographs illustrate gas holes, segregation, microshrinkage (both sponge and feather) and foreign matter in castings of ¼ and ⅜ inch thickness. The illustrations are designated by number according to ASTM standard E 52. Each radiograph is held in an 8½ x 11 in. cardboard form and each radiograph illustrates eight grades of severity for a discontinuity in a 2 x 2 in. area. Twenty-five frames are bound in a ring binder.

This set may be obtained from ASTM Headquarters, 1916 Race Street, Philadelphia 3, Pa. at $125.00 each.

VACUUM METALLURGY CONFERENCE

The topics and speakers for the fourth annual summer conference on vacuum metallurgy at New York University's College of Engineering were announced today (Saturday, April 2).

The program, designed for practicing engineers, will be given June 1, 2, and 3 on NYU's University Heights campus in the Bronx. It will include 30 lectures and several discussions.

Speaking briefly at the opening session, which takes place at 9:15 a.m., Wednesday, June 1, will be Dr. John R. Ragazzini, dean of the College of Engineering; Dr. John P. Nielsen, chairman of the department of metallurgy; Dr. Harold K. Work, director of the College of Engineering's Research Division;

continued on page 96

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saves 35 MACHINING OPERATIONS with INVESTMENT CASTING

This barrel of a .22 caliber target revolver is now being cast by Hitchiner's new ceramic shell process. This new investment casting technique provides sufficient close tolerances and finishes to eliminate the need for 35 machining operations. Gun barrel tolerance of 0.006 inch was normal, but plus over minus 0.001 inch was maintained on certain areas. Only external finishing needed was partial polishing.

These savings have allowed the manufacturer of this revolver to sell it for considerably less than a similar previous model.

Through investment casting, parts can be designed for function and maximum operating efficiency with the widest selection of alloys from which to choose. This freedom from manufacturing problems can result in more flexibility in design and less waste in production.

Send us a sample or blueprint and check your specific problem with our "engineered quotation" — no obligation, of course.

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Formerly a zinc base die casting . . . now sintered brass for a higher melting point for use on insulated files.

According to Mr. George Paul, Chief Engineer, Sargent & Greenleaf, Inc., "A number of powdered metal parts producers were contacted to make these low cost, close tolerance, complex parts. Reese was the only one interested. We now find other practical applications and will, of course, use Reese as our prime source".

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"How to Cut Precision Parts Cost with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.

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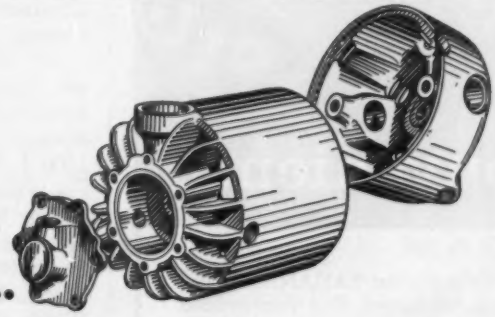

and MILWAUKEE has what it takes!

Among other needed factors, it takes a staff of trained die casting engineers . . . skilled die designers . . . die builders . . . machine operators . . . plus an intimate knowledge of the die casting process, its limitations and possibilities. Most important, it takes the kind of *know how* acquired only through years of specialization in the design and production of die castings in many shapes and sizes for thousands of different applications.

A pioneer of the die casting industry, Milwaukee offers everything you need for the production of fine die castings . . . completely modern plant facilities . . . highly skilled technicians . . . and more than 50 years of continuous service to die casting users throughout industry.

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and Dr. Rointan F. Bunshah, chairman of the conference.

The following is the schedule of speakers and topics:

Wednesday, June 1

–Thomas M. Krebs and Leonard S. Dorsett, The Babcock and Wilcox Company, "Hydrostatic Compaction of Consumable Electrodes from Metal Powders and Sponge."

–T. E. Butler and R. P. Morgan, Union Carbide Metals Company, "The Oscilloscopic Analysis of Arc Behavior in Consumable Electrode Furnaces."

–Heinz G. Sell and A. E. LaMarche, Westinghouse Electric Corporation, "The Partition of Power in High Current-Low Pressure Metal Vapor DC-arcs: A Theoretical Interpretation Based on Arc Melting Experiments with Tungsten and Tungsten Base Alloys."

–A. E. LaMarche, Westinghouse Electric Corporation, "Vacuum Arc Melting of Tungsten-Molybdenum Alloys and Pure Tungsten Using DC Straight Polarity as the Power Source."

–Henry M. Eikenberry, James W. Mahaffey, and Robert B. Steck, National Lead Company of Ohio, "New Developments in the Vacuum Melting and Casting of Uranium in Tonnage Quantities."

–Robert B. Steck, Henry M. Eikenberry, and D. DeTrou, National Lead Company of Ohio, "The Effect of Furnace Pressure on Uranium Ingot Chemistry and Metal Quality."

–Russell G. Hardy, Oregon Metallurgical Corporation, "Shaped Titanium Castings."

–Russell G. Hardy, Oregon Metallurgical Corporation, "Centrifugal Pipe Casting of Uranium and Tungsten."

–A. E. LaMarche, Westinghouse Electric Corporation, "Vacuum Arc Skull Casting of Molybdenum-Tungsten Alloys and Pure Tungsten."

Thursday, June 2

–T. H. Crane, High Vacuum Equipment Corporation, "The Management and Maintenance of Vacuum Systems."

–W. A. Matejka, Kelsey-Hayes Company, "Vacuum Induction Casting Techniques."

–C. R. Benson, General Electric Company, "Vacuum Induction Melting of Alloys for High-Strength Forgins in the 1100°F to 1400°F Temperature Range."

–William J. Boesch, Metals Division, Kelsey-Hayes Company, "Production and Properties of the Superalloy Udimet 700."

–Marlin S. Walmer, Hamilton Watch Company, "Precision Control of Boron 10 Isotope Analysis in a Modified 304 Stainless Steel."

–Pierre P. Tuxrillon, Metals Division, Kelsey-Hayes Company, "Stainless Steel Containing Boron 10."

–Philip S. Schaffer, Ordnance Corps, Watertown Arsenal, "Production of Superior-Quality Ultra High-Strength Steel Castings by Vacuum Induction Melting."

–Lynn E. Sprague, The Steel Improvement and Forge Company, "Effects of Vacuum Melting–Techniques on Fabrication and Mechanical Properties of Forgings."

–George E. Danner and G. Taylor, Erie Forge and Steel Company,

continued on page 98

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It is a good example of high utilization of the die casting process for mass production parts.

The Master Design Guide for the seasoned and skilled mechanics at Madison-Kipp, in cooperation with customer designers, is high level quality, from high level tooling for low secondary labor content.

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VACUUM CONF. — *cont.*

"Vacuum Deoxidation of Large Ingots."

—William Wilson, A. Finkl & Sons Company, "Mechanical Properties of Slack Quenched, Degassed Steels."

—William Wilson, A. Finkl & Sons Company, "Argon Teeming of Degassed Steel."

Friday, June 3

—H. A. Steinherz, NRC Equipment Corporation, "Ultra High Vacuum Techniques for Industrial Size Systems."

—Hugh R. Smith, Jr., Temescal Metallurgical Corporation, "Design and Performance Parameters of Commercial and Laboratory Scale Electron Beam Furnaces."

—H. H. Hoffman, Olin Mathieson Chemical Corporation, "Vacuum Joining by Electron Beam Welding."

—A. Calverley, Services Electronics Research Laboratory, England, "The Role of Electron Bombardment Heating in Metallurgical Research."

—W. C. Necker, General Electric Company, "Zone Purification of Ytrium."

—Louis Ianniello, Rensselaer Polytechnic Institute, "Zirconium Base—Rare Earth Alloys."

—D. L. Sullivan and N. I. Ananthanarayanan, "Miniature Resistance Furnace for Vacuum Evaporation of Metals and Alloys."

—M. Gilbert, F. J. Stokes Corporation, and B. Rogers, Catalyst Research Corporation, "Heavy Coatings by Vacuum Metallurgy—Applications and Methods."

—J. L. Pritchard, Canadian Vac-Hyd Processing, Ltd., and Joseph Jenkins, N.A.S.A., Cleveland, "Vacuum Brazing in Nuclear Structures."

—A. A. Machonis, Sylvania Research Laboratories, "Oxidation Resistance and Vacuum Hot Hardness of Refractory Tungsten Base Alloys Prepared by Arc Melting."

Co-sponsors of the program are the department of metallurgical engineering at NYU's College of Engineering and the University's Office of Special Services to Business and Industry.

The deadline for registration is May 15. Further information can be obtained from: Mr. M. Berk, New York University College of Engineering, University Heights, Bronx 53, New York.

NEW VICE PRESIDENTS AT DIXON CRUCIBLE

H. Edward Ehlers and Warren A. Zimmer, have been elected executive vice presidents of the Joseph Dixon Crucible Co., Jersey City, N.J., it was announced by Frank G. Atkinson, president.

Dixon and its six subsidiary companies comprise one of the world's largest manufacturing enterprises based almost wholly upon the application of graphite. Among the industrial output of the combined companies are pencils—including the world famous brand, Ticonderoga—and related writing products such as art pencils, industrial crayons, pencil sharpeners, erasers, school chalks, artists' paints and educational art materials; graphite lubricants, crucibles, refractories, industrial maintenance paints and powdered metal components.

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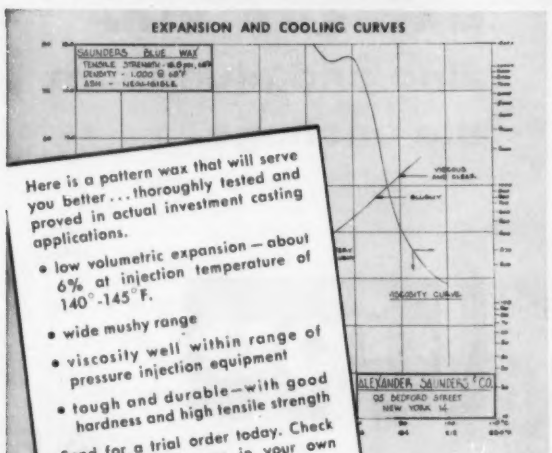

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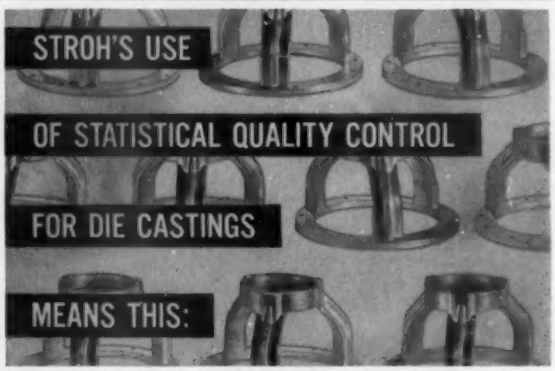

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SPRINKLERS

continued from page 53

parts are then dipped in Zinodine for priming, are dried, and sprayed with a baking enamel.

To avoid the need for threading the assembly holes, Beinert uses self-tapping screws to assemble the housing. Studs in the base of the housing fit into holes in the mounting plate and are staked, avoiding the need for screws, threading, or rivets. The base is fastened to the aluminum tubing skids with self-tapping screws.

The skids and the spray tube are bent to shape in simple press fixtures. All the holes in the spray tube are drilled at once with a multiple-drill set-up.

The control dial is plastic, with a die-cast indexing collar. The water motor itself and its various gears are molded of nylon, although in some models the impeller is die cast.

A number of Melnor designs are topped with a textured, anodized aluminum plate. Here again die castings show to advantage, according to Beinert. The die cast bases are cast with shoulders having indents. Tabs on the textured plates are folded into the indents. Result is a striking-looking finish at low cost.

The use of both the die casting process and the extrusion process to manufacture components for these lawn sprinklers emphasizes, once again, the need for the industrial designer to have a sound working knowledge of manufacturing processes. There's no profit in developing a product design with all of the most desirable functional and asethetic features, if it can not be made economically.

Then there's the other side of the picture. With a good knowledge of what can, and can not, be made by the various low-cost manufacturing methods, the designer is frequently able to come up with a product which has superior operational characteristics and better looks. He knows, for example, that permanent mold castings can be made with extremely complex coring because the casting process can use cores of metal, sand, plaster, and other materials. Thus the requirement of a straight pull on a core is eliminated.

When a textured or novelty finish is desired it can be cast. Thus an expensive surface finishing job is eliminated.

With the proper placement of stiffening ribs, very thin walled die castings can be made so that weight is greatly reduced without loss of strength where it is needed. Careful design will put bosses, lugs, integral rivets, and other fastening methods where they are needed so that secondary machining operations are reduced in both number and cost. In many cases, die castings are made which are so nearly complete, after trimming, that only low cost drilling operations are needed to complete them. In some cases not even these drilling operations are required.

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After 30 years of serving the die casting industry we have expanded to offer you complete die casting service.

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Our staff of experienced die casting engineers stay with the job from initial design to finished casting.

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Complete facilities to produce castings weighing 14 lbs. zinc.

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Plating of all sizes, weights, and types available, from barrel zinc to the most difficult, automobile bumpers.

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Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITIONS OPEN

DIE CASTING — SALESMAN
Rapidly expanding Southern California die casting plant has excellent opportunity for experienced die cast salesman. Must have minimum of five years experience selling die castings. Salary and commission. Qualified personnel mail complete resume to Box 5160.

SALES REPRESENTATIVES — ALUMINUM PERMANENT MOLD & DIE CASTINGS
Large Eastern foundry has openings for exclusive representation in New England, New York State, Eastern Pennsylvania. Require top flight men only, who are now selling allied lines. Write, listing details, including territory covered, lines handled. Box 5560.

MASTER DIE CASTER with proven supervisory experience wanted as partner to establish new eastern shop with substantial assured aluminum die cast business. Supply resume of educational background, experience, and previous earnings in first letter. Your confidence respected. Box 5360.

ENGINEER — SALESMAN
Leading, independent fabricator of powder metallurgy components offers an excellent opportunity for a self starting, aggressive man on its expanding sales force. Prefer individual with sales experience and technical degree. Ability to grasp mechanical design problems and metallurgical background important. Send complete resume to Compacted Metals Corporation, 99 Greenwood Avenue, Waukegan, Illinois.

PERMANENT MOLD ENGINEER
Experienced man to handle mold design and plant engineering. Excellent opportunity for right man with established growing organization in East. Box 5460.

ASSISTANT TO SALES MANAGER — To perform liaison function between sales and customers concerning engineering and production matters. Competency and experience in oral and written communications important. Experience with sales or engineering in investment castings desired. Precision Castparts Corporation, 4600 S. E. Harney Drive, Portland 6, Oregon.

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Die Casting Engineer with 20 years experience available after June 1, 1960. Ten years in die design — last ten as superintendent of complete operation from estimate thru production. Sales, engineering, or partnership interest. Box 5660.

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DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards facing the last page will get you these free reference materials. Circle the numbers and mail.

2. **Die Lubricant** — Acheson Colloids Co. — Technical bulletins — on colloidal graphite water base lubricants for use in dies and other abrasive, high temperature and pressure applications.

5. **Tool Steels** — Allegheny Ludlum Steel Corp. — Technical literature list — describes 125 technical publications on tool steels.

11. **Piston Rings** — Auto-Diesel Piston Ring Co. — Catalog — lists plunger rings, tips, liners and combination tip-rings.

14. **Sinterings** — Bunting Brass & Bronze Co. — Technical handbook — on the engineering and production of sintered metal parts.

15. **Clipping Press** — B. I. P. Engineering Ltd. — Technical data — on a 34 ton, fast cycle, hydraulic clipping press.

17. **Fire Resistant Fluids** — Celanese Chemical Co.—Information—tells how Cellulube fire resistant hydraulic fluids provide both safety and lubrication.

18. **Die Casting Machine** — Cleveland Automatic Machine Co. — Specifications — on a 1000 ton hydraulic die casting machine.

21. **Standard Unit Dies** — Detroit Mold Engineering Co.—Production information—tells how to make die changes in minutes with standard unit dies.

23. **Die Castings** — Dollin Corp. — 16-page facilities brochure — shows its techniques for zinc and aluminum die castings with rigid design requirements.

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28. **Investment Casting** — Hitchiner Mfg. Co. — 13-page booklet — explains the ceramic shell investment casting process and shows Hitchiner's facilities.

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33. **Die Casting Machines** — Kux Machine Co.—Catalog—gives complete specifications on a line of 28 die casting machines.

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53. **Barrel Finishing**—Electro Minerals Div. of the Carborundum Co.—Technical booklet—on the Carboltrol 7 Process.

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79. **Surface Finishing** — Almco Queen Products Div. — Literature — describes the latest metal surface finishing machines, methods and media.

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85. **Die Steel** — Universal-Cyclops Steel Corp. — Technical data — on a vacuum degassed die casting die steel said to give longer production runs.

88. **Laboratory Services**—Metal Control Laboratories—18-page booklet —describes metallurgical and laboratory services available.

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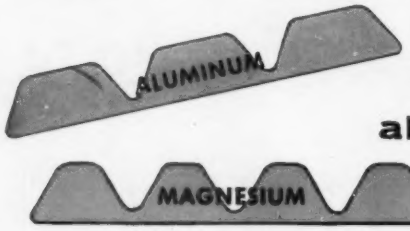

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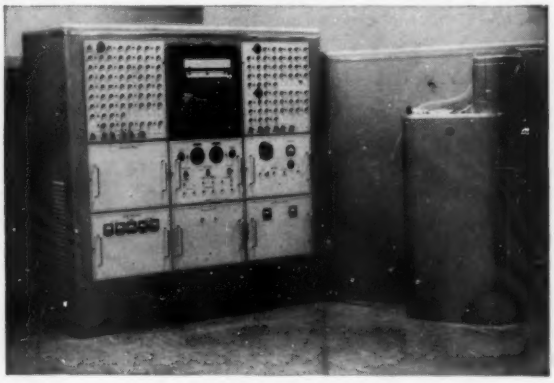

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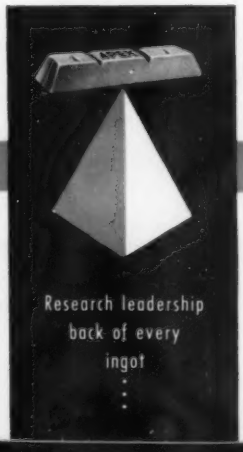

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